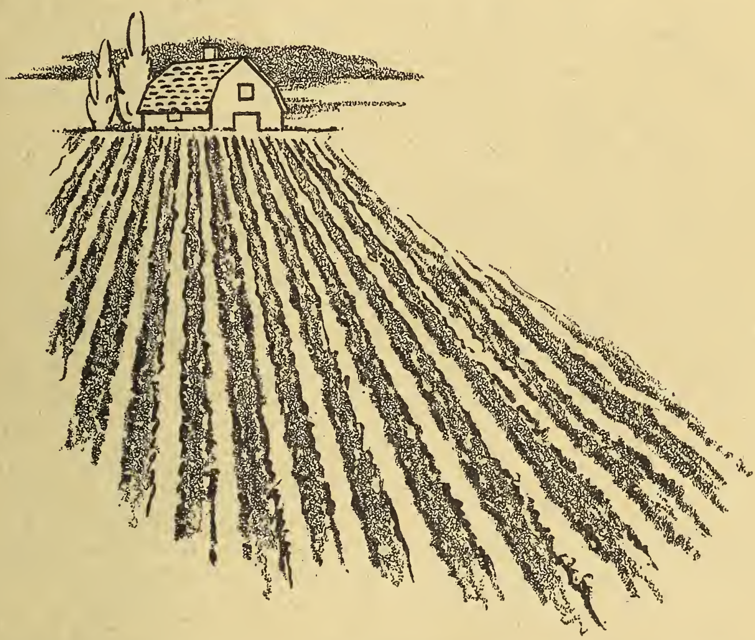
IRRIGATED FARMS IN A SUBHUMID COTTON AREA

Income Potentials and Development Problems



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UNITED STATES DEPARTMENT OF AGRICULTURE

In Cooperation With

Oklahoma Agricultural Experiment Station

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U. S. DEPARTMENT OF AGRICULTURE

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OKLAHOMA AGRICULTURAL
EXPERIMENT STATION

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Income Potentials and Development Problems

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Summary

The W. C. Austin Project, in the cotton and cash-grain farming area of southwestern Oklahoma, represents one of the first attempts to introduce irrigation of a project type into a subhumid area. Before irrigation, cotton farms averaged about 240 acres and cash-grain farms about 320 acres.

This multiple-purpose project was constructed to provide irrigation water, flood control, and a municipal water supply for the city of Altus. Irrigation construction costs are to be repaid in 40 equal annual installments. However, at the discretion of the Secretary of the Interior, a flexible payment plan based upon gross income may be required.

Water was delivered to a few acres in 1946, and to the entire project in 1950. The first payment on construction costs was made in 1951.

Irrigation charges per acre vary from year to year. In 1952 and 1953 minimum charges were $3.20 per acre for operation and maintenance (O and M) and $1.80 for cost of construction. From 1948 to 1950 an additional charge of $3.50 per acre-foot was made for all water delivered in excess of 0.5 acre-foot per irrigable acre. In 1951 the charge for additional water above 0.5 acre-foot was $4.00 per acre-foot, and in 1952 it was $5.00 for additional water above 1.0 acre-foot. Because of a shortage of water in 1953, only the minimum charges were levied—$3.20 an acre for O and M and $1.80 for construction.

[1] This was one of two studies developed by the former Bureau of Agricultural Economics (Production Economics Research Branch, ARS), in cooperation with State agricultural experiment stations, to provide economic information on project type irrigation development in subhumid areas. The other study was made of the Middle Loup Project in north central Nebraska.

Analysis of precipitation and temperature records 1914-52 indicates that there would have been a shortage of water in 16 of these 39 years. In 10 of these years, the shortage would have exceeded 50 percent of the requirements for irrigation water.

Certain problems of operation have arisen because of the water-supply characteristics of the project and the climate of the area. Rains of high intensity in the growing season make disposal of excess water difficult. Intermittent use of water during the long growing season has hampered control of weeds in canals, laterals, drain channels, and wasteways. It has been difficult to develop a satisfactory method of scheduling delivery of water. The fluctuating demand for water disrupts delivery schedules, and as a result, water is wasted.

In 1950 the project had about 355 farms. In terms of irrigable land, 3 size groups—60–99 acres, 100–139 acres, and 20–59 acres—included more than two-thirds of all farms on the project. Most project farms had both irrigated and dry land, although little of the dry land was within the project boundary. Farms with large irrigated acreages usually had more acres of dry land than had farms with small irrigated acreages.

A higher proportion of the irrigated than of the unirrigated land was in cotton and grain sorghums. More of the dry land was used for wheat and pasture. Most irrigated farms had small livestock enterprises.

Most farmers on the project acquired their knowledge of irrigation while on the project and while on their present farms. Many have been on their present farms for 5 or more years.

Thirty-nine percent of the operators are owners; 20 percent are part owners; and 41 percent are tenants. More than two-thirds of the landlords live in or near the project area. Sharecrop leases prevail, and rental shares are about the same as for dryland farms in the area. Rental shares most frequently reported for major crops were: Cotton, one-fourth; alfalfa hay, one-third; alfalfa seed, one-half; small grains, one-third. Landlords commonly pay all the cost of irrigation construction, a fourth of the charges for operating and maintaining the irrigation project, half the cost of harvesting alfalfa seed, and a share of the costs of fertilizer and insecticide proportionate to their share of the crop. They usually furnish all the alfalfa seed planted.

Irrigated farms on the project have increased somewhat in size since the project started. Acreages of dry land have expanded more often than have acreages of irrigated land. Expansion in acreage was reported more frequently on the larger than on the smaller farms. Of the 69 farms surveyed, 17 had increased and 7 had decreased in size since the first year of irrigation. The sample farms averaged 201 acres in the first year of irrigation and 215 acres in 1952.

Most farms on the project have buildings and facilities that are adequate for the present systems of farming. Expansion of livestock enterprises in this area would require additional investment in buildings, fences, and water systems on many farms. So far, farmers have invested very little in such irrigation structures as drops, flumes, turnouts, and permanent ditches.

Crop yields can be increased above present levels by improving production practices. Potential increases in yields are believed to be greater for irrigated than for dryland yields. Improved dryland yields can be

obtained through more general adoption of recommended insect-control measures; better tillage practices, especially for moisture conservation and weed control; improved rotations; and increased use and proper application of fertilizers. Improved practices needed on irrigated land include: Improved rotations that provide for a deep-rooted legume on at least a fifth to a fourth of the acreage; increased use and proper application of fertilizer; better insect and weed control; proper land development and preparation for irrigation; proper application of water; and improved tillage and seeding practices.

An analysis of hydrologic data for the project area indicates that water shortages are likely to occur more frequently in the second half of the year. Yields of alfalfa and cotton would be affected more frequently than would grain sorghums or wheat. With such shortages, it is estimated that, on the average, crop yields would be reduced 10 percent from levels attainable with a full water supply. On a typical 80-acre unit, average net labor incomes would be reduced 18 percent.

A 240-acre farm with 160 acres irrigable would provide more than twice the net income of an irrigable 80-acre unit, and it would almost double the return per hour to operator and family labor and management. This size of unit is large enough to permit economical use of 4-row equipment. It would provide adequate, though seasonally varying, employment for most farm families.

The contribution of irrigation to farm income was analyzed. The approach used was based upon the premise that the value of water is determined by the difference in farm incomes attainable by a farmer with average managerial ability, and with command over a given dollar value of resources, when these resources are invested in alternative irrigated and dry farms. Improved farming techniques were assumed in each case. The comparison made was between a 240-acre farm with 160 acres irrigable, and a 340-acre dry farm, in an area of deep, moderately heavy soils. At projected prices, the net difference in income attributable to water amounted to $4.33 per irrigable acre. With dry land valued at $80 an acre, and costs of land development for irrigation at $55 an acre, the net increase in income attributable to water capitalized at 5 percent would indicate an approximate value of irrigated land of about $222. With this method of calculation, the value of water might be influenced by size of farm.

Farmers and landowners on the project have spread their expenditures for land development and irrigation equipment over a period of years. Many of them expect to incur additional development costs in the future. Most of the equipment used by these farmers was acquired prior to irrigation.

Development of the project occurred in a period of favorable farm incomes. Farmers met costs of development largely from income or reserves, without going into debt.

With projected prices, and yields estimated on the basis of an accelerated 7-year development program, it appears that an 80-acre owner-operated field-crop farm could provide an adequate family living and repay the costs of developing the farm in 8 years. Funds would be available in the 8th year to begin repayment of project construction charges. If prices received in the development period declined an average of 5 percent from the projected level, the repayment of farm

investments would be extended into the 11th year with no provision for repayment of project costs. With a decline of 10 percent in prices received, farm development repayments would not be completed until the 19th year. An increase in prices received would permit more rapid retirement of these costs. Inclusion of an additional 80 acres of dry land would increase the repayment ability, and it would shorten the repayment period. With prices received at 90 percent of the projected level, sufficient income could be accumulated to repay the costs of farm development in the 8th year. With projected prices, costs of farm development could be repaid as incurred, after the 2d year, and payment on project construction charges could begin in the 3d year.

Other economic aspects of development of irrigated farms that should be investigated include effect of irrigation upon stability of income; desirability of irrigating a small acreage with a reliable water supply, as compared with using the same quantity of water on a larger acreage to supplement rainfall; place of irrigated pastures and livestock systems on irrigated farms; economic possibilities of production of specialty crops; need for improvement in facilities for financing costs of farm development; and effects of an irrigation project upon the stability and economic development of an area.

Problems Involved

Introduction of irrigation into a subhumid area brings with it problems in land-use adjustment and farm management. Most of the problems do not differ from those that accompany irrigation in arid regions, but because of the subhumid environment some of them have unique aspects.

A farmer anywhere who undertakes to irrigate all or part of his land must first find the answers to these questions:

What system of farming is likely to be most profitable under irrigation?

Is it better for all the land in the farm to be irrigated, or should it include some nonirrigated land?

Do existing dryland farm units contain about the right number of acres for an irrigated farm that is to be managed by a typical farm family? This question needs to be examined from the viewpoints of both adequacy of income and efficiency in use of labor and equipment.

What changes in farming practices from present-day farming methods are needed? For example, adjustments may need to be made in seeding rates, in use of fertilizer, and in insect-control practices.

How much income can be expected from an irrigated farm, if the operator has average managerial ability and carries on good farming practices?

How rapidly can and should an irrigated farm be developed?

How can development of a farm for irrigation be financed?

Under arid conditions, successful operators of irrigated farms have been meeting and solving these problems for many years. Their experience provides much information concerning the factors that influence the successful development of irrigated farms in arid regions.

Farming practices that have proved successful under arid conditions, however, cannot always be applied in subhumid areas. In arid regions, when irrigation is introduced into an existing economy of ranching or extensive crop farming, it is recognized that the size of the farm unit will

change under irrigation. Crop enterprises are also likely to change under irrigation, and the need to learn the proper techniques for growing new crops is recognized from the outset. In most subhumid areas, crop farming has been carried on without irrigation with moderate success under average management, and many medium-sized and small farms are usually found in these areas. The extent of change, if any, to be desired in cropping programs and in size of farm units as a result of irrigation is problematical. The tendency has been to superimpose irrigation on existing sizes and types of farms. Also, when irrigation water is applied to established crop enterprises, the tendency is to continue previous production techniques unchanged.

An objective of the study reported here was to analyze the development of irrigated farms on the W. C. Austin Project in the light of the questions listed. Only partial answers to these questions can be given. In this report, attention is focused particularly on improvements in farm practices, minimum size of farm needed for income and efficiency, integration of dry and irrigated land, and time required to repay farm-development costs as affected by changes in prices. Adjustments made in size of farm, in crop and livestock systems, and in cropping practices should provide helpful guides to development of irrigated farms in comparable areas.

Source and Limitations of Data

Data for this study were drawn primarily from the experience of farmers in the W. C. Austin Project, supplemented by estimates and recommendations by specialists in the Oklahoma Agricultural Experiment Station and the United States Department of Agriculture. Attention was given to preliminary unpublished results from the experimental fields on the project and from experiments on irrigated cotton at Tipton, Okla. Helpful information was obtained also from experiments made at the Iowa Park Experiment Farm near Wichita Falls, Tex., and from irrigation studies in the High Plains, made by the Texas Agricultural Experiment Station.

Effects of irrigation on yields and farming systems in a given area cannot be fully evaluated until results of years of field experimentation and trial-and-error experience of farmers are known. Irrigation in the W. C. Austin area is too recent to permit the drawing of more than preliminary conclusions. Findings in the study are only tentative guides to development of irrigated farms, farm practices, and selection of enterprises. They are subject to amendment and additional refinement as further information becomes available.

The Area

Land served by the W. C. Austin Project lies in parts of Jackson and Greer Counties in southwestern Oklahoma. Most of the irrigable lands are within a 15-mile radius of Altus, Okla. The project area is in the Red River watershed, and project lands drain toward the Salt Fork and North Fork tributaries of that stream. The project storage and diversion works, which consist of Altus Dam and appurtenant structures, are on the North Fork of the Red River, 18 miles north of Altus.

The project is located in a subhumid rainfall area which has a mean yearly rainfall of 25.5 inches. Annual rainfall and its seasonal distribu-

tion vary greatly. The minimum recorded rainfall was 13.9 inches in 1917; the maximum, 48.6 inches in 1941. It is not uncommon for dry years to occur consecutively. The area is subject to torrential rains. Seasonal droughts often occur even in years when total annual precipitation is average or above.

Temperatures vary greatly. Summers are long and hot, and winters are short, though often severe. Temperatures of more than 100 degrees, which are often associated with strong winds and low humidity, are

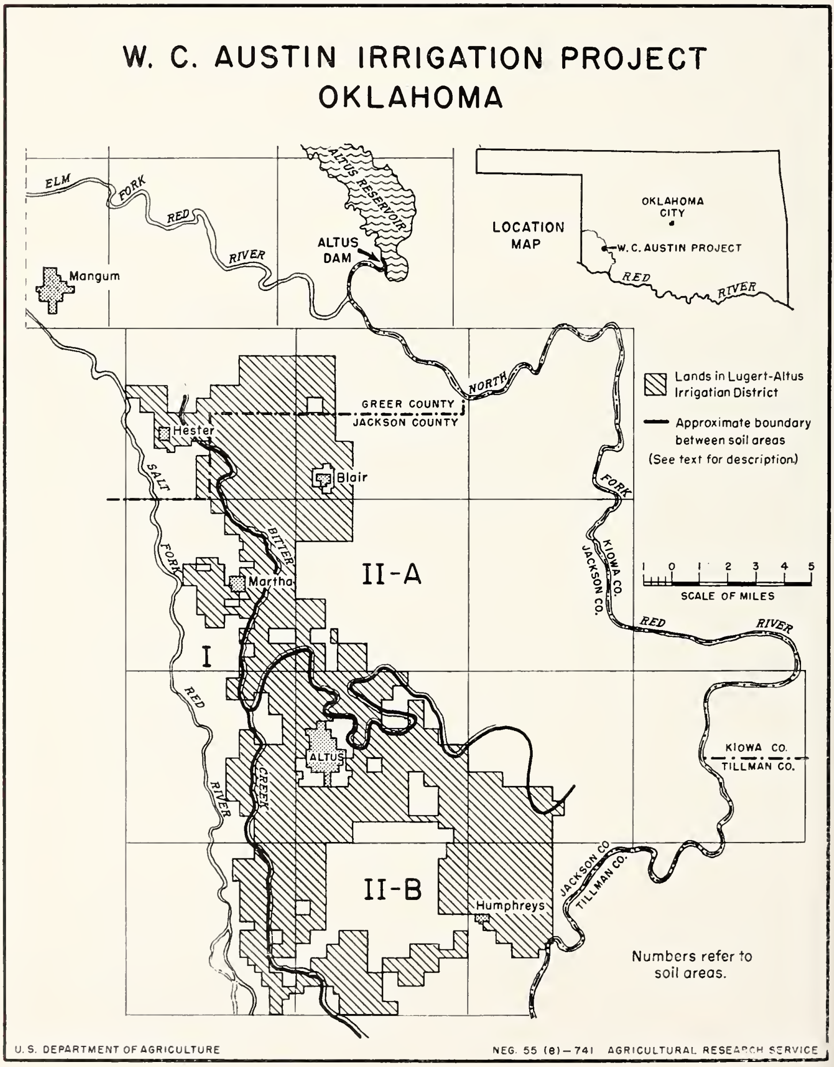

FIGURE 1.—Map of the Lugert-Altus Irrigation District, showing district boundaries and generalized land areas used in this study.

common. Extremes of recorded temperatures at Altus are 120° and minus 11° F. The growing season averages 226 frost-free days.

Soils are sedimentary in origin and are generally underlain by Permian Red Beds. Soil types range from very light sandy loam to heavy clay loams with heavy subsoil. Depth of soils and alkali content vary considerably throughout the project.

For the study reported here, soils in the area were grouped into three land classes which have similar crop distributions, tillage practices, yields, and recommended rotations and fertilizer applications. Generally, as to suitability for irrigation, class I corresponds with Bureau of Reclamation class I, and classes II–A and II–B with Bureau of Reclamation class II. The classes are described as follows:

Class I—*Nearly level land on old stream terraces.* This group of soils is deep (more than 60 inches), with medium-textured surfaces (silt loams and very fine sandy loams) and with friable clay loam subsoils that drain well. The major soil series are Tipton and Enterprise.

Class II–A—*Slowly permeable sandy land on gentle slopes.* These soils are moderately deep (approximately 30 inches), with sandy loam or fine sandy loam surface soil and moderately heavy clay subsoils that take in water slowly and are slow to drain off excess water. (A perched water table is often found after periods of excessive rainfall or excessive irrigation.) The major soil series are Tillman and Headrick.[2]

Class II–B—*Very slowly permeable hard lands on nearly level to moderate slopes.* These soils are predominantly deep, although some are moderately deep to shallow. Surface textures are silt loams and clay loams that are moderately granular. Subsoils are heavy clays with blocky structure that take in water slowly and are slow to drain off excess water. Major soil series are Foard and Tillman.

Other—The major part of the irrigation district is included in the land classes just listed. For several other small areas of minor importance, rotations, yields, and applications of fertilizer were not considered. Although of minor importance with respect to area involved, an area classified as *permeable sandy land on gentle slopes* (sandy land west of Bitter Creek) presents special problems of leveling and seepage on the lower lying, adjacent area of sandy land. This group of soils is moderately deep (approximately 30 inches), with sandy loam or fine sandy loam surface soil and sandy clay loam subsoils that are readily permeable to water and drain well. Major soil series are Enterprise and Abilene. Most of the area is included in Bureau of Reclamation class I land. The general areas in which these classes predominate are shown (fig. 1).

About a third of the farms in southwestern Oklahoma were classified as cotton farms in the 1950 Census of Agriculture (*8*).[3] Data refer to State Economic Area No. 4, which includes 11 southwestern Oklahoma counties. Classification depends upon 50 percent or more of income being derived from a specified product or group of products. Eighteen percent were cash-grain farms; 11 percent were livestock farms and ranches, not including dairy and poultry farms. Most of the remaining farms were diversified, general-crop farms. Cotton farms were reported to average about 240 acres, and cash-grain farms about a half-section. Wheat and

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[2] Uncorrelated.

[3] Italic numbers in parentheses refer to Literature Cited, p. 61.

cotton are the predominant crops on these farms. A considerable acreage of sorghum is grown, mainly for grain. Most of the crop farms have small acreages of pasture. Other minor crops include alfalfa and oats, and considerable alfalfa seed is produced. Livestock enterprises on most farms are small.

The W. C. Austin Project

There was local interest in irrigation in the area before statehood, as evidenced by engineering studies as early as 1902. Continuing local interest resulted in investigations by several agencies in 1937. Results of the investigations were coordinated into a final report and published by the Congress in 1938 (*9*). The multiple-purpose project for irrigation,

FIGURE 2.—Recreational opportunities in southwestern Oklahoma have been enhanced by construction of Altus Reservoir. (United States Bureau of Reclamation photograph.)

flood control, and municipal water supply was authorized in 1938, and the findings of feasibility were approved by the President on February 13, 1941. In addition to these purposes, construction of Altus Reservoir has provided fish and wildlife benefits, and the State Park Service has expanded the recreational facilities of Quartz Mountain State Park adjacent to the reservoir (fig. 2).

The Lugert-Altus Irrigation District, an irrigation district, body corporate, and political subdivision of Oklahoma, was organized in 1940. A contract between the Federal government and the district, which provided for construction of the project, was entered into on January 12, 1942. As set forth in the contract, repayment of the construction obligation of the

irrigation district is to be made in 40 successive, equal, annual installments. However, a provision in the contract provides that whenever the Secretary of the Interior in his judgment determines it to be practicable, the district may be required to make payment on its construction obligation on the basis of the "normal percentage" plan. In general, this plan provides that the annual payment may be increased or decreased in accordance with the relationship between annual and normal gross value of crop production for the project unit.

Requirements and provisions for filing recordable contracts and for sale of excess lands are included in the contract. This was done to comply with reclamation laws, which restrict delivery of water to individual holdings under the project of no more than 160 acres of irrigable land and to holdings of no more than 320 acres owned jointly by husband and wife.

TABLE 1.—*Water charges, W. C. Austin Project, 1946-53*

Year	Water rental levy per acre	Operation and maintenance per acre	Construction charge per acre	Quantity of water allowed	Charges for all water delivered per acre-foot	Charges for each additional acre-foot
	Dollars	*Dollars*	*Dollars*	*Acre-feet*	*Dollars*	*Dollars*
1946					4.50	0
1947					4.50	0
1948	2.75			0.5		3.50
1949	2.75			.5		3.50
1950	2.75			.5		3.50
1951		2.75	1.25	.5		4.00
1952		3.20	1.80	1.0		5.00
1953		3.20	1.80	([1])		([1])

[1] Because of the shortage of water in 1953 no charges were levied except the flat charges for operation, maintenance, and construction. An average of 0.17 acre-foot per acre was delivered.

Construction of the project began in 1941 but work was stopped after the entry of the United States into World War II. Construction was resumed early in 1944 and completed in 1949. Water was first delivered to a small acreage in 1946. The project consists of a concrete and masonry dam on the North Fork of the Red River, which forms a reservoir with a capacity of 148,000 acre-feet, and 270 miles of canals and laterals. Storage capacity is allocated to silt storage, irrigation storage, and municipal water supply. Storage capacity above the spillway level is allocated to flood control.

As of June 1953, the cost of construction of the project was $12,858,385, of which $8,085,102 was from Works Progress Administration and other nonreimbursable funds. The repayment obligation was $3,080,000, of which irrigable lands are to repay $2,000,000. The project is obligated to deliver to Altus 4,800 acre-feet of water annually, for which the city has a repayment obligation of $1,080,000.

The obligation for repayment of construction costs by irrigable lands is a little more than $1 an acre per year for the 40-year repayment period.

The first payment on the cost of construction was made in 1951. Table 1 shows water-rental levy, operation and maintenance charge, charge for all delivered water, quantity of water allowed under minimum charge, and charge for additional water, by years.

Water Supply and Probable Water Requirements

The project was designed to utilize, insofar as practicable, the water available from the streamflow. Article 3 of the repayment contract of January 12, 1942, which was approved by the landowners, reads in part as follows:

> . . . investigations of the water supply and proposed canal system indicate that, dependent on the annually varying stream flow, an area varying from year to year between approximately 20,000 acres and not exceeding 70,000 acres of the irrigable lands of the District, potentially can be irrigated from the water supply to be made available by and through the works proposed to be constructed by the United States, but that the total area of lands within the boundaries of the District is expected to exceed the acreage which can be continuously irrigated to maximum benefit from the water supply which will be made available from the said proposed works; . . .

To exclude some landowners who were not interested in irrigation, to reduce the cost of the project's distribution system, and to confine irrigation to the better lands, the irrigable area was reduced to 48,000 acres. The main canals, however, were designed with sufficient capacity to supply water for 70,000 acres.

The United States Bureau of Reclamation has recently made an analysis of probable water requirements, based on water delivery to key tracts by crops and correlated with mean monthly temperatures and total precipitation at Altus, for the period between planting and harvesting of crops. Using an anticipated crop distribution, and precipitation records at Altus for 1913-52, the average annual farm-delivery requirement for the 40 years was computed to be 1.5 feet per acre. For 1948-52, the average annual water delivery per cultivated acre was 1.0 acre-foot to the key tracts[4] and 0.73 acre-foot to the entire project.

In 1952 a water shortage developed late in the growing season. Many farmers said that their yields of major crops were decreased because of it. Average delivery of water to key tracts in 1952 was 1.3 acre-feet per cultivated acre and 1.1 acre-feet to the whole project. At the beginning of 1953, little water remained in the reservoir for irrigation. Inflow to the reservoir was slight. One irrigation run was made on the basis of providing 1.4 inches of irrigation water per irrigable acre. This release resulted in a delivery of about 5,500 acre-feet of water to farms. It was used on about 15,000 acres, planted principally to cotton.

Some information is available as to the frequency of water shortages, based on present average use of water on key tracts. In conjunction with its study of the use of water, the United States Bureau of Reclamation calculated the number of years of water shortage and the extent of water shortage there would have been in the last 40 years had the reservoir been in operation. The Bureau of Reclamation considered the reservoir empty at the beginning of the 40-year period. Thus, if one excludes the first year, and 2 years when the shortage would have been only 2 percent of the diversion demand, there would have been a water shortage in 16 of the 39 years. The shortage would have ranged from 24 to 100 percent of the

[4] Selected tracts on which the Bureau of Reclamation keeps detailed records.

diversion demand. In 10 of the years, it would have exceeded 50 percent.

Water supplied by this project is generally suitable for irrigation, although salinity may cause some problems in the irrigation district. The literature (*5*) states: "From a limited number of chemical analyses of water samples from the reservoir, indications are that the quality of water will average around 1,000 parts per million of total dissolved solids with 40 percent of the cations being sodium. Water of this quality is generally satisfactory for irrigation use; but because of the heavy soils that exist over large areas of the project, saline conditions must be watched particularly where rising water tables are encountered."

Operation of the Project

Although the project has been operated successfully thus far, many problems have arisen. The project is unique in that it lies in a subhumid rainfall area and has problems of operation, maintenance, and administration not common to irrigation in arid regions. The area has always had the problem of disposal of excess water from high-intensity rains in the growing season. Irrigation has aggravated this problem of surface drainage, even though 40 miles of drains were installed as part of the project. These high-intensity rains in the growing season, when canals are full, mean that the distribution systems must be emptied rapidly. Also, the dumping of large quantities of water and debris into the canals and laterals requires the dispersal of operating personnel to strategic waterway structures, to prevent damage to irrigation works. This is one cause of the high maintenance costs associated with the project.

Intermittent use of water from February through November of each year has promoted a rank growth of weeds in canals, laterals, drain channels, and wasteways. In some instances, clogging of these channels has disrupted and impaired delivery of water. Mechanical control of weeds in canals is prevented by the long seasonal demand for water. This necessitates the use of expensive chemical control, and it contributes to the high cost of maintenance.

Scheduling water deliveries is a major problem in operating the project. Rains in the growing season, and the tendency of farmers to wait until their crops suffer from lack of water before irrigating, prevent the scheduling of deliveries of water to fit the distribution system and to maintain uniform flow. This results in heavy demand for water in short periods. It requires a distribution system with sufficient capacity to permit irrigation of most of the project lands within a week or 10 days. It was fortunate that the project was designed to serve a larger acreage and that, as a result, the distribution system has a large capacity.

Fluctuating demand for water causes frequent changes in delivery schedules. The frequent slackening of demand for water following rains has caused water to be turned into wasteways. Thus, its beneficial use is lost. Ability to divert part of this water into the Altus city reservoir has somewhat lessened the waste of water. The construction and use of holdover reservoirs has been considered as a possible solution to this problem.

Several methods of scheduling delivery of water have been tried. In 1946, water was supplied on a demand basis to a small acreage. In the early part of 1947, water was delivered as nearly as possible in the order of requests, which resulted in continual shifting of heads and waste of

water. In the latter part of the 1947 season, water was delivered to farmers on a demand-rotation basis. Requests for water had to be submitted in advance. Deliveries were started at the head of each ditch rider's district and rotated down the district. The quantity of waste water was reduced, but the date of delivery of water to farmers was uncertain. The weekly demand-rotation basis used in 1948 and 1949 allowed any farmer to receive water at some time in each week in summer and at some time in each 2-week period in spring and fall. In 1950 the system of periodic runs was changed to one of continuous delivery. Farmers were required to order water a minimum of 3 days in advance of deliveries. This system was used until a water shortage developed in the latter part of the 1952 growing season.

Demand for water is continuous. Demand is light, except in fall, when rainfall is excessive, and in the coldest part of winter. In early spring and fall, when demand is light, continuous runs of water are uneconomical from the viewpoint of both cost of operation and maintenance and use of water. Attempts to get farmers to coordinate their operations, so that deliveries of water can be grouped into occasional runs, have been only partially successful. It is anticipated that future methods of delivery and quantities of water allowed under minimum charges will vary because of attempts to provide water to users in accordance with their needs, to minimize costs of operation and maintenance, and to conserve water.

Present Farm Organization and Tenure on Irrigated Farms

Present patterns of size, organization, and tenure of farms on the W. C. Austin Project indicate the kind of agricultural economy that is likely to be found in comparable areas in the early years of irrigation. Since the project was established, gradual adjustments have been made in size of farm, land use, and tenure. Further adjustments may be expected.

Number and Size of Farms

In 1950 the project contained about 355 separate operating units.[5] Many of these farms included land outside the project boundaries. These operating units should not be confused with the "farm unit" designation of the United States Bureau of Reclamation, which refers to ownership tracts that are sometimes combined with other farm units to make an operating unit. In determining the number of operating units, farm units were combined as in the United States Census, if the land was farmed under one management.

Size of farm in the project cannot be measured adequately in terms of irrigable land. Most farms include some land that is nonirrigable, and for all farms in the project the average acreage of nonirrigable land exceeds the irrigable acreage. Most nonirrigable land is outside the project. Integration of irrigable and nonirrigable land on farms in 1950 is shown (table 2). Acreages shown include both owned and rented land.

Table 2 shows that about a fourth of the irrigated farms have less than 20 acres of nonirrigable land, but that 40 percent of them have 100 or

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[5] Estimated on the basis of irrigation district records and Production and Marketing Administration data. The year 1950 was chosen in preference to a later year because the PMA worksheet coverage for 1950 was more complete.

more acres. A higher proportion of farms with small irrigable acreages have little or no dry land than of farms with large irrigable acreages. With less than 100 acres of irrigable land, the proportion with less than 20 acres of dry land is about a third; with 100 acres or more irrigable, this proportion is 5 percent or less.[6]

Table 2.—*Farms in the W. C. Austin Project, classified by acreage of irrigable and of nonirrigable land, 1950* [1]

Acres of irrigable land	Acres of nonirrigable land					
	1–19	20–99	100–259	260–379	380 and up	All sizes
	Number of farms	*Number of farms*	*Number of farms*	*Number of farms*	*Number of farms*	*Number of farms*
1–19	7	5	5	0	3	20
20–59	21	19	13	7	5	65
60–99	26	26	22	5	8	87
100–139	4	49	13	2	7	75
140–179	20	7	5	3	3	38
180–379	2	14	15	4	6	41
380 and up	0	1	2	0	12	15
All sizes	80	121	75	21	44	341

[1] Compiled from Production and Marketing Administration records in Jackson and Greer Counties, Okla. A few irrigated tracts were omitted for which complete operating-unit data could not be obtained.

Most farms on the project have a combination of irrigable and nonirrigable land, but there is no pronounced tendency for nonirrigable land to be associated with a small irrigable acreage in order to make up an efficient size of unit. Conversely, irrigation apparently has caused operators of large irrigable acreages to divest themselves of control over nonirrigable land. The present pattern probably reflects the size distribution of operating units that existed when the project was developed. Recent changes in the farm-unit pattern are discussed later.

Tenure, Land Use, and Farm Organization

Average acreages, irrigable and nonirrigable, by tenure and distribution of major uses for these classes of land, are shown (table 3). Comparable figures are also given for nonirrigated farms in an area immediately surrounding the W. C. Austin Project. (For comparable data for farms in the irrigated area, shown by land classes, see appendix tables 56, 57, and 58.)

In both irrigated and dryland areas, farms operated by part owners are considerably larger than farms that are entirely owner-operated or rented.

On irrigated farms, 98 percent of all irrigable land was in crops, com-

[6] The 140- to 179-acre group is an exception. This is because 160 acres is a common size of *total* unit, and all farms with a high irrigable acreage must necessarily fall in the class with those having very little dry land.

TABLE 3.—*Average acreages, land use, and major crops, by tenure of operator, project farms and farms in surrounding area, 1950* [1]

Tenure and land group	Average acres per farm	Percentage of total land in farm			Percentage of cropland			
		Crop	Pasture	Other	Wheat	Cotton	Grain sorghum	Alfalfa
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Irrigated project farms:								
Owner-operators								
Irrigable land	128	98	0	2	30	26	22	9
Dry land	147	70	24	6	41	9	13	8
All land	275	83	13	4	35	18	18	9
Part owners:								
Irrigable land	188	98	0	2	28	28	23	5
Dry land	349	69	23	8	40	10	13	8
All land	537	79	15	6	35	18	17	7
Tenants:								
Irrigable land	110	98	0	2	15	31	29	10
Dry land	110	82	11	7	38	12	23	10
All land	220	90	6	4	26	22	25	10
All irrigated farms:								
Irrigable land	132	98	0	2	25	28	24	8
Dry land	172	73	20	7	40	10	16	9
All land	304	83	12	5	32	19	20	8
Surrounding dryland farms:								
Owner-operators	239	77	14	9	36	22	21	7
Part owners	366	78	13	9	40	20	19	8
Tenants	267	82	9	9	31	26	23	9
All dry farms (weighted average)	270	80	11	9	34	23	22	8

[1] Compiled from Production and Marketing Administration data for Jackson and Greer Counties, Okla. Sample of dryland farms included all farms adjacent to the project.

pared with 73 percent of nonirrigable land. Of the land on dry farms, 80 percent was used for crops.

Distribution of major crops shown in the table refers to 1950 and is therefore not typical of some recent years, as in 1950 cotton acreage allotments were in effect. But relationships between use of irrigable and nonirrigable cropland are of interest. For all tenure groups, the proportion of cropland in cotton was much higher on irrigable than on nonirrigable land. The proportion in grain sorghum also was higher on irrigable land, while the proportion in wheat was much lower. There was little difference between the two classes in proportion of cropland in alfalfa.

When use of land on nonirrigated farms is compared with use of nonirrigable land on irrigated farms, the main differences are that irrigated farms use more of their dry land for pasture and have much less of their dry cropland in cotton.

Numbers of livestock reported on sample farms according to the 1953 survey are shown (table 4). As there did not appear to be a close relationship between livestock enterprises and land-class area or size of farm, data are presented for all farms in the sample. Most farms had some kind of livestock. Chickens were kept on about half the farms. Beef and dairy cows were reported on about 40 percent of the farms. Hog, sheep, and feeding enterprises were of minor importance.

TABLE 4.—*Livestock on 69 farms, W. C. Austin Project, May 1953* [1]

Item	Farms reporting	Percentage of all farms	Average number of livestock per farm reporting
	Number	*Percent*	*Number*
Farms reporting some kind of livestock	58	84	----------
Beef cows	27	39	12.8
Other beef cattle	27	39	11.3
Dairy cows [2]	26	38	5.0
Other dairy cattle [2]	15	22	4.8
Sows farrowed during year	5	7	1.2
Ewes	3	4	144.0
Feeder cattle bought in 1952	3	4	33.6
Feeder pigs bought in 1952	3	4	34.6
Feeder sheep bought in 1952	1	1	250.0
Hens	33	48	42.6
Turkeys	1	1	65.0

[1] Except as indicated.
[2] Of a dairy breed.

Farm Operators

Mobility and Irrigation Experience

Most farmers on the project acquired their knowledge of irrigation on the project and on their present farms (table 5). Only 7 of the 69 farmers interviewed said they had experience with irrigation in other

areas. The relatively stable tenure of farm operators on the project is shown by the fact that 53 of these farmers had been on their present farms for 5 or more years. However, this does not necessarily mean that changes in operators on many rented tracts do not occur from year to year. A slightly higher proportion of farmers on the smaller irrigated units had moved to their farms in the last 5 years than on the larger units.

TABLE 5.—*Number of years operator has been on present farm, and previous irrigation experience, sample farms, W. C. Austin Project, 1953*

Size of farm, irrigable acres	Number of farms	Operators reporting: Years on present farm: 1–2 years	3–4 years	5–6 years	7 years and over	Previous irrigation experience: Operators	Place
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	
20–59	9	1	3	0	5	1	Imperial Valley, Calif.
60–99	25	5	1	6	13	3	Arizona and California; Altus area on old pipeline; Fort Stockton, Tex.
100–179	23	0	4	5	14	2	Arizona and California; western Texas
180–379	12	1	1	1	9	1	California.
Total for sample farms	69	7	9	12	41	7	

With 39 percent of the irrigated farm units entirely owned by operators, the percentage of owner-operated farm units is about the same as for the surrounding dryland area (table 6). Also, the percentage of farm operators who are part owners and tenants is about the same for the irrigation project area[7] as for the dryland area. There are about as many owners as renters on the project. Only slightly less than half the land in the project is farmed by owners. According to the United States Bureau of Reclamation crop census, 48 percent of the irrigated land was operated by owners in 1948, 54 percent in 1950, and 45.5 percent in 1952. Three-fourths of the renters of irrigated land rent from only one landlord, while 9 percent rent from 3 or more landlords.

Ownership of Irrigated Land

Practically all project lands are owned by individuals. Size of holdings of irrigated land is restricted by reclamation laws that prohibit delivery of water to farms of more than 160 acres of irrigable land owned by individuals, or to farms of more than 320 acres owned jointly

[7] The term "Project area," as used here, refers to project land and outlying dry land farmed by irrigation farmers.

TABLE 6.—*Distribution of farm operators by tenure; tenants by number of landlords; and landlords by residence, project and surrounding farms, 1950* [1]

Land-class area and type of farm	Tenure			Part owners with—			Tenants with—			Residence of landlord		
	Owner	Part owners	Tenant	One landlord	Two landlords	Three landlords or more	One landlord	Two landlords	Three landlords or more	In area	Out of area	Out of State
Irrigated farms:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Land class area I	43.6	16.0	40.4	73.3	20.0	6.7	79.0	18.4	2.6	78.0	8.8	13.2
Land class area II–A	35.2	18.3	46.5	92.3	7.7	0	93.9	6.1	0	81.6	14.3	4.1
Land class area II–B	38.5	23.1	38.5	74.4	12.8	12.8	73.8	13.9	12.3	58.4	18.6	23.0
Average of all areas [2]	39.2	19.1	40.7	77.6	13.4	9.0	80.2	13.2	6.6	68.9	14.9	16.2
Dryland farms	41.5	14.6	43.9	83.3	26.7	0	75.0	19.4	5.6	66.7	9.8	23.5

[1] Compiled from 1950 Production and Marketing Administration records.
[2] Weighted average.

by husband and wife. Inspection of assessment rolls and water-payment records indicate that several family groups have large holdings of land on which ownership-management functions are probably exercised by one individual.

Of the 54.5 percent of the irrigable land not operated by owners in 1952, approximately 30 percent was owned by landlords who resided outside the area immediately surrounding the project. Approximately 18 percent of the owners of rented land lived outside the State. Percentage distribution of residence of landlords for the project and surrounding area is shown (table 6).

Rental Arrangements

The 69 farms for which rental information was obtained were restricted to the more common sizes of irrigation units. Terms of leasing might differ somewhat on small and large farms. On the farms studied, crop-share leases were most common. Of the operators interviewed, only 6 of 45 operators who rented irrigated land rented any for cash. More land may be rented for cash by operators of large units and growers of specialty crops, for which equitable rental shares are more difficult to determine than for the farmers interviewed. Leases were found to be primarily 1-year oral leases.

Table 7.—*Most common share-rent terms*

Landlord's share	Cotton	Alfalfa	Grain sorghum	Alfalfa for seed	Small grain
Crops	1/4	1/3	1/3	1/2	1/3
Expenses:					
Water	1/4	1/4	1/4	1/4	1/4
Seed	0	All	0	All	0
Fertilizer	1/4	1/3	1/3	1/3	1/3
Combining and baling	----------	0	----------	1/2	----------
Picking cotton	0	----------	----------	----------	----------
Spraying	1/4	1/3	0	1/3	1/3

The landlord's share of different crops varies somewhat, but it tends to be the customary share for dryland crops in the area. Of the operators interviewed, with only one exception, the share of cotton received by landlords was one-fourth. In the one instance, the landlord received half the cotton, but he furnished the machinery, fuel, and seed, in addition to the share of expenses he would ordinarily bear. The landlord's share of alfalfa varied somewhat more than for other crops—a few landlords received two-fifths and one-half the crop instead of the customary one-third. The share of alfalfa depended upon the proportion of the charge for water and the cost of seed borne by the landlord. For cotton, the share of the water charge borne by the landlord was usually in proportion to the rental share. On a given tract with more than one crop and with different rental shares, the tendency was for the landlord to bear a fixed share of the cost of all water used on the tract. As cotton

is the major crop grown on most tracts, the crop-rental share of cotton and the share of the water charge borne by the landlord were usually the same, applied to all crops on the tract. Representative landlords' shares of crops and expenses for major crops are shown (table 7). In addition, a few landlords furnish special irrigation equipment. (See appendix table 59.)

Buildings and Facilities

Nearly all farms on the project have some improvements, most of which were constructed prior to the development of irrigation. The present values of improvements now on farms are indicated by size of farm (table 8). The average value of buildings other than the house is low and does not vary significantly by size of farm, except that in the smallest size group values tend to be higher than in other groups. The value of the dwelling, however, decreases as irrigable acreage increases. On most farms, buildings consist of a barn or shed, a garage and chickenhouse, and perhaps one or two other miscellaneous structures.

TABLE 8.—*Average value of specified improvements, by size of farm, 69 survey farms, W. C. Austin Project, 1953*

SIZE AND NUMBER OF FARMS

Item	Irrigable acres per farm				
	20–59	60–99	100–179	180–379	All sizes
	Number	*Number*	*Number*	*Number*	*Number*
Farms reporting any improvement	9	23	23	11	66

AVERAGE VALUE OF IMPROVEMENTS [1]

Item	20–59	60–99	100–179	180–379	All sizes
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Improvements:					
Dwelling	5,662	4,179	3,622	2,473	3,870
Barns	1,446	852	1,316	1,218	1,136
Other buildings	704	326	542	385	467
Fences	270	249	364	178	277
Irrigation structures	266	188	218	1,020	378
Farmstead water system	281	186	204	163	198
All improvements	7,059	5,397	4,727	4,581	5,544

[1] Per farm reporting.

Buildings on farms that include separate irrigated and nonirrigated tracts are usually on the irrigated part. Of the 69 farmers interviewed, 46 live on or adjacent to the irrigated part of the farm, 5 on a separate dryland tract, and 18 in town. The tendency to live off the farm did not vary consistently with size of farm.

As a rule, there is little fencing on these farms except around the

farmstead and an occasional pasture. Electric fencing is often used for temporary pasture.

On about two-thirds of the farms, the domestic water supply consists of wells (appendix table 60). The average depth of the wells is 31 feet. Most of the other farms have cisterns. About a third of the farms have pressure water systems. Well water is sometimes unpalatable because of the concentration of salts.

Expansion in livestock enterprises in this area would require a considerable investment in buildings, fences, and water systems on many farms.

Thus far, farmers on this project have not invested heavily in such irrigation structures as drops, flumes, turnouts, or permanent ditches. Few turnouts in the farm-distribution system are made of concrete. Canvas instead of concrete checks are used, and ditches are rarely lined. The average value of irrigation structures is low, except for the largest size group (table 8). There is considerable uncertainty as to the type of ditch and irrigation structure to use and the place for permanent structures on the farm. Several farmers indicated that they planned to make major changes in location of ditches. This would permit them to use the water more efficiently as the land is more adequately developed for irrigation.

Current Land Values

Estimated values per acre for irrigable and dry land are shown (table 9). These values reflect market values of farms without buildings at the time of the survey. Values of irrigable and dry cropland tend to

TABLE 9.—*Estimated market value per acre of farmland by land-class area, W. C. Austin Project, May 1953* [1]

Area	Irrigable land		Nonirrigable cropland		Nonirrigable pasture	
	Farms reporting	Value per acre	Farms reporting	Value per acre	Farms reporting	Value per acre
	Number	*Dollars*	*Number*	*Dollars*	*Number*	*Dollars*
I	27	258	18	122	12	38
II-A	16	231	16	102	7	38
II-B	26	233	23	111	12	43
All areas [2]	69	[3] 241	57	[3] 113	31	[3] 40

[1] Excludes value of buildings.
[2] For description of predominant soils in each area, see page 9.
[3] Weighted average.

be somewhat higher in land area I than in the other areas, but the value of dryland pasture is lowest in area I. More of the nonirrigable pasture in area I is rough, broken land than in other areas. Farmers indicated that values of irrigated land had recently declined. It was their opinion that the water shortage developing in late 1952 and continuing in 1953 was primarily responsible for the decline.

Farming Adjustments on Irrigated Farms

Inspection of the annual crop-census returns for the W. C. Austin Project, and information contained in the 1953 survey, reveal that project farmers are making many adjustments in size of business and in farm enterprises. Apparently, however, irrigation has not materially affected the rate of turnover of farm operators.

Changes in Size of Operating Units

Size of farm has tended to increase since the first year of irrigation.[8] Increases in nonirrigable land have been more frequent than for irrigated acreage. Of the 69 farms surveyed, 25 percent increased in net size[9] during the period, and 10 percent decreased in net size. Twelve farmers expanded their acreages of irrigable land, but 10 reduced their acreages. Nonirrigable acreage was expanded on 14 farms and reduced on only 5. For all farms in the sample, total acreage of land averaged 201 acres the first year of irrigation and 215 acres in 1952.

Adjustments in acreage made by farmers by 1952, by size of irrigable unit, are shown in table 10. More complete details are given in appendix table 61.

TABLE 10.—*Adjustments in acreage, by size of irrigable unit, W. C. Austin Project, from first year of receiving irrigation water to 1952*

Irrigable acreage	Farms making adjustments in acreage operated					
	Irrigable land		Nonirrigable land		Net size [1]	
	Increase	Decrease	Increase	Decrease	Increase	Decrease
	Number	*Number*	*Number*	*Number*	*Number*	*Number*
Under 100 acres (34 farms)	3	5	4	3	4	4
100 acres and over (35 farms)	9	5	10	2	13	2

[1] In equivalent acres, with 1 irrigable acre calculated as equal to 3 nonirrigable acres.

Adjustments made on the farms with the smallest irrigable acreage tend to cancel each other—about as many farms drop acreage as add to it. On larger farms, a considerably higher proportion of farmers have added irrigable or nonirrigable land than have reduced acreage.

Changes in Crop Enterprises

Use of cropland on the project prior to irrigation, and for each year since 1946, is shown (table 11). These figures are taken from the annual crop census; they refer, in the early years of the project, only

[8] The period of years reported by each farmer varies with the date on which water became available to him and the year he moved to the farm, if later.

[9] Calculated on basis of 1 irrigable acre 3 nonirrigable acres.

TABLE 11.—*Crop distribution before and after irrigation development, W. C. Austin Project* [1]

Crop	1944–46 [2] average	Year 1946	1947	1948	1949	1950	1951	1952
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Barley						0.8		
Corn			(3)	0.1	0.1	.6	0.1	(3)
Oats				1.1	.6	1.0	.3	1.4
Wheat	39.0			15.3	21.7	21.6	5.5	4.1
Grain sorghum	5.0	18.1	9.7	17.0	7.4	21.7	7.6	4.3
Alfalfa seed			5.1	2.1	3.8	4.9	4.0	4.0
Alfalfa hay		3.0	19.5	11.4	6.8	6.9	6.6	9.2
Other hay		2.8	1.3	2.7	.9	.8	1.1	1.4
Irish potatoes		(3)	(3)		2.1	1.4	.8	1.6
Spinach		(3)				.9		
Cotton	23.0	63.3	60.2	39.3	50.6	27.7	63.8	61.2
Castorbeans						1.6	1.2	.9
All other crops	(4)	12.7	4.1	10.1	4.8	7.4	7.8	10.1
Soil building				.9	.2	.9	.2	.2
Fallow					1.0	1.8	1.0	1.6
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Total acres, of crops irrigated [5]		451	3,490	19,431	42,207	51,405	48,843	46,898

[1] Percentages of crops based on total acres (7).
[2] Crop distribution for project area before irrigation was introduced.
[3] Less than 0.1 percent.
[4] Information not available.
[5] Includes double cropping.

to land irrigated. Water became available to all project lands in 1950, and since then all crops grown on irrigable land are reported.

The dominant position of cotton on these farms is apparent. Large acreages of wheat and grain sorghum were substituted for cotton in 1950 as a result of acreage allotments. Various specialty crops have been introduced on a few farms, chief of these being potatoes and castorbeans. Acreages of these two crops have fluctuated considerably. Apparently, the acreage of potatoes has not tended to expand, and the acreage of castorbeans has declined. Spinach was grown only in 1950; results were disappointing, partly because of a late freeze.

Other specialty crops that have been tried on small acreages include onions, popcorn, watermelons for seed, sweetpotatoes, cowpeas (black-eyed peas), Austrian peas, vetch, annual and biennial sweetclovers, and pasture mixtures, as reported in (*6*) and other sources.

Changes in Livestock Enterprises

Indications of changes in livestock enterprises were obtained in the 1953 survey. These are summarized (table 12). For each livestock enterprise listed, except sows, the number of farmers who reported expansion exceeded the number who said they had reduced the size of their enterprises. On the whole, changes in size of enterprises were moderate.

Table 12.—*Number of farmers reporting a change in size of livestock enterprise, from first year of irrigation to 1952*

Enterprise	Farmers reporting		
	Increases	Decreases	No change [1]
	Number	*Number*	*Number*
Beef cows	13	10	7
Other beef cattle	17	7	6
Dairy cows	15	8	8
Other dairy cattle	10	5	3
Sows farrowed	2	4	3
Ewes	2	0	1
Feeder cattle	3	0	0
Feeder pigs	2	0	2

[1] Includes only farms that had specified kinds of livestock.

Farming Practices, Crop Rotations, and Yields

Most agricultural technicians in the Altus area believe that yields of both dry and irrigated crops can be improved. This opinion is based primarily on results obtained by farmers who follow improved farming practices. Estimates of yield for major irrigated and dryland crops with improved practices, as compared with present yields, indicate greater room for improvement of yields on irrigated than on nonirrigated land. Irrigation has been practiced in the area for only a short time, and many farmers have not had time to adopt the best methods. In

TABLE 13.—*Estimated present and attainable dryland and irrigated crop yields, by areas, W. C. Austin Project* [1]

Crop	Area I		Area II–A		Area II–B		Project average	
	Present	*Attainable*	*Present*	*Attainable*	*Present*	*Attainable*	*Present*	*Attainable*
Dryland:								
Cotton lint ... pounds [2]	230	265	165	185	150	175	180	205
Alfalfa for hay and seed:								
Hay ... tons	1.1	1.4	1.0	1.3	.9	1.2	1.0	1.3
Seed ... cwt. [3]	2.2	2.4	2.6	2.8	2.4	2.6	2.4	2.6
Grain sorghum ... cwt	10.5	15.0	9.2	12.5	9.2	12.5	9.6	13.3
Oats ... bushels	17.0	21.0	15.0	18.0	15.0	18.0	15.6	19.0
Wheat ... do	17.0	18.0	14.0	15.0	14.0	15.0	15.0	16.0
Irrigated:								
Cotton lint ... pounds [4]	425	710	365	555	375	590	390	620
Alfalfa for hay only ... tons	2.8	4.6	2.3	3.8	2.2	3.8	2.4	4.1
Alfalfa for hay and seed:								
Hay ... do	2.3	3.4	1.8	2.7	1.7	2.7	1.9	2.9
Seed ... cwt. [3]	2.6	2.8	3.4	3.6	2.0	2.2	2.5	2.7
Grain sorghum ... cwt	17.0	27.5	15.0	23.5	15.0	25.5	15.6	25.7
Oats ... bushels	24.0	47.0	17.0	38.0	17.0	38.0	19.3	41.0
Wheat ... do	18.0	39.0	16.0	30.0	17.0	33.0	17.1	34.3

[1] Estimated to be attainable by average managers through use of improved rotations and practices, including adequate use of fertilizers and insect control. It is believed that this level of yields might be attained by average managers under a vigorous educational program in about 10 years. (Estimates developed in cooperation with specialists in Oklahoma Agricultural Extension Service and Experiment Station, and with the Soil Conservation Service.)

[2] Weight of cottonseed = 1.7 times the weight of lint.

[3] Yield obtained when seed crop taken (every other year).

[4] Weight of cottonseed = 1.8 times the weight of lint.

addition, fewer experimental results have been available on which to base recommendations for improved irrigation farming practices.

An experiment station and a demonstration farm are operated in the project area by the Oklahoma Agricultural Experiment Station. Not enough time has elapsed to obtain experimental results on which to base definite recommendations.

Dryland Practices and Yields

Increases in average yields for the major dryland crops in the area can be obtained by more general adoption of these practices: Improved insect control; better tillage, especially for moisture conservation and weed control; recommended crop rotations; and increased use of fertilizer and its proper application. Cultural practices to which attention should be given are those most in need of improvement on cotton farms in southwestern Oklahoma (*1*). In estimating future average yields attainable in about 10 years, continued educational and technical assistance in the area that would result in general adoption of these practices was assumed. These projected yields for dryland farms in the area are shown (table 13). Estimates are made for the purpose of placing dryland yields on a comparable basis with anticipated future irrigated yields. Fertilizer applications and a rotation considered adequate to obtain these yields, by land classes, are given in appendix table 43.

Irrigation Practices and Yields

Present Practices and Effect on Yields

Most farmers on the project were well established in dryland farming before the advent of irrigation. Although few had had previous experience with irrigation, the major crops grown under irrigation had also been grown under dryland conditions. Irrigation was readily accepted by farmers, but they were slow to make many of the necessary changes in their practices. Also, the problems encountered in applying irrigation to an already developed system of farming were new to many agricultural workers.

Although present irrigated yields on the project are somewhat higher than dryland yields, average yields can be further improved. Annual crop yields on the project are shown (table 14).

TABLE 14.—*Average yield of crops, W. C. Austin Project, 1946-52* [1]

Crop	1946	1947	1948	1949	1950	1951	1952
Barley ---- bushels			35.0	50.0	6.8		
Corn ---- do		40.0	18.7	35.5	19.2	20.8	37.5
Oats ---- do			19.4	32.1	1.4	15.0	24.7
Wheat ---- do			25.2	12.8	12.7	12.4	22.2
Grain sorghum ---- cwt	17.1	15.4	12.9	13.1	19.8	17.0	13.0
Alfalfa seed ---- cwt		.4	1.0	1.5	1.0	1.7	3.3
Alfalfa hay ---- tons	2.3	2.0	2.9	2.0	1.4	2.0	2.3
Irish potatoes ---- bushels		162.5		145.5	249.7	241.8	187.3
Cotton lint ---- pounds	490.0	365.0	435.0	390.0	350.0	305.0	325.0
Castorbeans ---- tons					.46	.38	.18

[1] See (7).

Yields of cotton, the principal irrigated crop, vary widely among irrigated tracts. According to the Bureau of Reclamation crop census for 1952, 41 of 597 tracts had yields of 1 bale or more and 41 had yields of less than 200 pounds of lint cotton. Six farmers reported yields for individual tracts in excess of 650 pounds of lint cotton. This indicates that farming practices strongly influence yields. In order to relate practices to yields for cotton, information on 1952 yields and the factors relating to them were obtained from farm operators for 65 irrigated tracts. These tracts were grouped by yields. Factors that affect yields are shown by yield classes (table 15). Increased yields are associated with increased use of fertilizer, better insect- and weed-control programs, preirrigation, and more frequent irrigations.

Attainable Yields

Based on experience in other irrigated areas and on observation of yields obtainable by the more progressive irrigation farmers in the area, and assuming that the educational and technical services now provided will continue, estimates were made by local agricultural technicians of yields that are attainable by 75 percent of the irrigation farmers on the project within the next 10 years. These yields are shown by land classes in table 13. An acceptable rotation, and fertilizer applications that are considered at least adequate to maintain these yields, are shown in appendix table 43. No attempt is made to make specific recommendations for rotations or applications of fertilizer.

Improved Practices

Improved crop rotations.—Land in the project, dry-farmed for many years, is low in fertility. Proper response from irrigation can only be obtained by proper use of commercial fertilizer and rotations to correct the low organic content of the soil. Increased use of deep-rooted legumes (clover or alfalfa) and summer legumes is needed. The present recommendation is that rotations should be used in which all land is in a deep-rooted legume every 4 or 5 years.

Increased use of fertilizer.—Farmers in the area should realize that higher yields with irrigation remove more plant nutrients than yields under dryland farming. Certain of these plant nutrients need to be replaced in varying quantities to maintain yields; and to increase yields on depleted land, the level of these nutrients must be increased. Use of commercial fertilizers, along with other improved practices, has given good yield responses in the area. Contacts with farmers in the area indicate that an increasing number are using fertilizer and that those who use it are increasing their applications. More research on use of fertilizer in the area is needed as a basis for making recommendations.

Better insect-control program.—With irrigation the insect problem has become more severe. It is believed that this is mainly a result of the heavier vegetative growth. In recent years damage by insects, especially to cotton, has been a major problem. Evidence of this damage to cotton is shown (table 15). Farmers in the area need a better understanding of insect-control programs. With better insect control many could increase their yields substantially.

Proper development.—Much of the land is not adequately leveled. Many farmers reported that they planned additional leveling. To handle alfalfa properly in their rotations, farmers believe that additional

leveling is needed so that a graded border system of irrigation can be used. In many instances, irrigation runs should be shortened. More ditches are also needed. If the land is nearly level, temporary ditches may be used.

TABLE 15.—*Relationship between yield of cotton and various factors, W. C. Austin Project, 1952*

Factors that affect yield	Yield of lint				
	100–199 pounds	200–299 pounds	300–499 pounds	500 pounds and over	Average [1] or total
Total farms reporting....number [2]..	4	13	36	12	65
Average yield per acre of lint....pounds..	158	250	377	529	366
Tracts owned....number..	0	6	16	8	30
Tracts rented....do.....	4	7	20	4	35
Use of fertilizer:					
Using nitrogen....do.....	0	2	11	5	18
Nitrogen used per acre.pounds..	....	9.6	15.5	39.0	21.4
Using phosphate.....number..	0	2	8	1	11
P_2O_5 used per acre....pounds..	....	16.4	17.5	20.0	17.5
Farm spraying or dusting..number..	4	9	27	11	51
Average times sprayed or dusted....do.....	1.5	1.7	2.4	3.7	2.5
Cultivations, average....do.....	4.2	4.8	4.7	5.7	4.9
Hoeings, average....do.....	1.0	1.9	1.9	2.2	1.9
Farms preirrigating....do.....	1	4	22	8	35
Other irrigations, average....do.....	2.8	2.1	2.7	3.6	2.8
Insect damage:					
Farms reporting....do.....	4	12	31	10	57
Average estimated yield decrease......pounds..	167	131	200	201	183
Inadequate moisture damage:					
Farms reporting......number..	0	8	19	8	35
Average estimated yield decrease......pounds..	....	168	103	138	126
Late planting:					
Farms reporting......number..	2	....	....	1	3
Average estimated yield decrease........do.....	169	....	....	106	148

[1] Weighted average.
[2] Data refer to 1 irrigated tract on each farm reporting.

Proper application of water.—The irrigation project was developed primarily as a source of water to supplement rainfall. Agricultural technicians in the area question the soundness of this concept, in which irrigation is thought of only as an insurance factor for a dryland farming system. Farmers tend to delay irrigation until their crops suffer from lack of soil moisture. They need to be able to predetermine when a crop will need water so they can make more timely applications, as rigid irrigation schedules for crops are not adapted to the rainfall pattern of the area. More preirrigation is needed when soil moisture is deficient

at planting time. Also, many farmers should supervise their irrigation runs more closely.

Other practices.—Agricultural technicians in the area believe that yields can be further improved if plant populations are increased, better adapted crop varieties are used, weed control is improved, plowing is deeper, chiseling is done in some instances, and seedbeds are better prepared.

Income Possibilities on Irrigated Farms

Income possibilities for each of the 3 major soil areas were first examined for some typical present-day farm organizations on 80-acre irrigated farms. Potential increases in income that would result from suggested rotations and improved farming practices, under assumed conditions of management and prices, are discussed in this part of the report. These farms indicate the approximate minimum size of farm, under given price conditions, for average managers on irrigation projects similar, except for water supply, to the W. C. Austin Project. Effect upon income of an additional 80 acres of dry cropland is examined for 1 area.

Analysis also is made of a larger, partly irrigated farm with 160 acres of irrigable land and 80 acres of nonirrigable land. This size of unit represents the legal maximum acreage of irrigable land permitted in one ownership on a reclamation project. The combination of irrigable and dry land is typical of many farms on the W. C. Austin Project. Income from this farm is compared with the income that could be obtained from a dry farm of a size that would represent the same investment.

Very few farms on the project have substantial livestock enterprises at present. To see the kind of income that might be attainable with a livestock program, a 160-acre farm in area II-B, with 80 acres irrigable, is budgeted as a beef enterprise.

Prices and costs used in the following analysis are shown in appendix tables 44 to 51. The projected prices were developed by the United States Department of Agriculture for use in connection with comprehensive agricultural river-basin and flood-control programs and projects. They are not forecasts; they are developed on the basis of specific assumptions of an expanding economy and high-level employment. These prices reflect a national parity situation in which the indexes of both prices received and paid by farmers are "215" on a 1910–14 base. In November 1953, the United States index of prices received by farmers was "249," and that of prices paid was "277." The parity ratio was 90.[10]

Production practices, labor requirements, and other information useful in budgeting, are given in appendix tables 52 to 55. The assumptions used in constructing the budget are stated in the appendix (pp. 63–65).

Estimates of yield are based on an adequate water supply, although this condition does not exist in all years on the project. But the primary purpose of this analysis is to indicate possibilities on future projects, and it is assumed that these projects will have an adequate supply of water. The probable effect of a limited water supply is briefly examined.

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[10] The index of prices received by Oklahoma farmers was also "249." No index of prices paid is available for Oklahoma.

Small Cotton Farms

Typical crop and livestock organizations on 80-acre farms in the 3 major soil areas on the project are summarized (table 16). Acreages shown reflect the cropping program for 1952. Acreage of cotton is considerably above the average for recent years. It is doubtful whether present yields could be maintained for any length of time if the acreage of cotton were kept at 84 percent of all land in crops, as shown for area II–B, or even at 69 percent as shown for area II–A.

TABLE 16.—*Organization of typical 80-acre cotton farms, by area, W. C. Austin Project, 1952* [1]

Item	Area I	Area II–A	Area II–B
	Acres	*Acres*	*Acres*
Irrigated crops:			
Cotton	41	52	63
Alfalfa, for hay	19	16	12
Alfalfa, for seed	0	0	(2)
Grain sorghum	5	7	0
Nonirrigated crops:			
Wheat	10	0	0
Farmstead and miscellaneous	5	5	5
Total	80	80	80
	Number	*Number*	*Number*
Cows, milk	1	1	1
Hens, chicken	25	25	25

[1] Acreages are based upon survey averages for a typical 80-acre farm with adjustments made to eliminate minor crops grown on only a few farms. Livestock numbers reflect the modal situation.
[2] Seed crop taken in place of one cutting of hay.

Ten acres of nonirrigated wheat are included in the present cropping program on the farm in area I. This approximates the typical situation on 80-acre farms in the area, as revealed by the survey.[11]

Livestock numbers shown—1 milk cow and 25 hens—are representative of many small farms on the project.

Present investments on these farms are about as shown in table 17. Buildings, most of which were put up before the farms were irrigated, are usually not elaborate. On most farms, buildings include a house, a general-purpose barn, and a few other outbuildings. Fences are usually limited to the enclosure of a farmstead and perhaps a few acres of pasture. As a rule, the whole farm is not fenced.

Domestic water systems usually consist of wells, cisterns, or both, without pressure systems.

Values shown for land are based upon the value of dry cropland without buildings, as reported by farmers surveyed, plus the undepreci-

[11] Of the 8 farmers interviewed, 5 reported irrigable land not irrigated.

ated value of leveling and borders constructed to the date of the survey. Values of dry land are used rather than present values of irrigated land, so that the analysis can be applied to conditions in an area to be developed rather than to conditions in a presently irrigated one. As a consequence, net incomes on the basis of values of dry land reflect returns to the first generation of settlers who would be able to obtain land at dryland prices. As an irrigation project is developed, a part of the increased income becomes capitalized into land values. Subsequent generations of farmers who buy land at irrigated-land values will find that, as a result, income available for family living will be reduced accordingly.

Table 17.—*Investment on typical 80-acre cotton farms, W. C. Austin Project, 1953*

[Prices and values adjusted to "215" index][1]

Item	Area I	Area II–A	Area II–B
	Dollars	*Dollars*	*Dollars*
Livestock [2]	150	150	150
Crop and feed inventory	20	20	20
Machinery [3]	2,905	2,905	2,905
Fences [4]	199	199	199
Buildings (excluding dwelling) [4]	1,151	1,151	1,151
Irrigation structures [4]	200	200	200
Domestic water system [4]	72	72	72
Land [5]	7,808	6,800	7,280
Total investment, excluding dwelling	12,505	11,497	11,977
Dwelling	4,100	4,100	4,100

[1] Based on United States average, 1910–14 = 100.

[2] Estimated on basis of numbers or values reported by farmers in survey.

[3] Calculated on basis of equipment needed for these farms (valued at 55 percent of cost new). It is assumed that machinery is half worn out, with allowance for salvage value (10 percent of new cost).

[4] Project average, adjusted for size of farm for irrigation structures, as there was no significant variation by areas.

[5] Value is farmers' estimate of dryland crop value plus average cost of land leveling as reported by farmers, adjusted to "215" index.

Differences among the soil areas in receipts from 80-acre farms, as shown in table 18, are primarily influenced by variations in acreage of cotton in 1952. The fact that 10 acres of irrigable land in area I were not irrigated also lowered receipts from farms in this area.

Increased gross income in areas II–A and II–B was largely offset by higher expenses, particularly for custom work. Outlays for custom services are the largest item of expense on these farms.

Custom charges are included for pickup baling of hay, combining, cleaning alfalfa seed, application of anhydrous ammonia, cleaning out the main lateral on the farm, and any cotton picking that cannot be taken care of with operator and family labor. On these small farms.

it is cheaper to hire the labor for the combining and hay baling than to own the necessary equipment, unless the farmer does custom work for others.

Net returns available to pay for operator and family labor and management at the "215" level of prices are somewhat below the income standard used by the Bureau of Reclamation. That Bureau estimated a minimum adequate level of living, at the "215" price level, to be about $2,045, including perquisites except housing.[12]

TABLE 18.—*Receipts, expenses, and net income, 80-acre cotton farms with present practices and average management*

[Prices and costs at "215" index]

Item	Area I	Area II–A	Area II–B
	Dollars	*Dollars*	*Dollars*
Receipts:			
Crops	5,382	5,897	6,140
Livestock	22	22	22
Total	5,404	5,919	6,162
Expenses:			
Fertilizer and insecticides	205	260	315
Custom work	1,339	1,490	1,772
Repairs, fuel, and oil	409	412	407
Depreciation	512	512	512
Taxes	94	84	90
Irrigation water, O and M	280	280	280
Miscellaneous	310	374	378
Total	3,149	3,412	3,754
Net farm income	2,255	2,507	2,408
Value of food furnished by farm	300	300	300
	2,555	2,807	2,708
Interest on investment [1]	625	575	599
Net return to operator for family labor, and management	1,930	2,232	2,109
	Hours	*Hours*	*Hours*
Operator and family labor	1,648	2,037	1,166

[1] At the rate of 5 percent on total investment excluding dwelling. (See table 17.)

As now organized, these farms do not require the full time of operator and family labor. This is particularly true of farms in area II–B, as a result of the high cotton acreage and the heavy reliance upon custom work for this crop. Distribution of labor requirements for these farms would be uneven during the year. It should be possible to improve incomes either by adding livestock or by doing custom work.

[12] Rental value of housing is sometimes figured at 5 percent of present value, which in this case would be $205.

FIGURE 3.—Some alfalfa hay is produced on most irrigated farms on the Austin project, usually for sale. An increased acreage of deep-rooted legumes would improve the structure and fertility of irrigated soils. (United States Bureau of Reclamation photograph.)

The discussion of cropping practices in the preceding section indicates that substantial improvement in farming practices is possible, particularly with respect to crop rotations, fertilizers, and insect control. Additional leveling of land is also needed.

An improved cropping system for cotton farms in the 3 soil areas is shown in table 19. In area I this rotation includes 3 years of alfalfa, a year of grain sorghum, 5 years of cotton, and a year of wheat or oats. The rotation for areas II–A and II–B is similar except that there is one less year for cotton (fig. 3).

Wheat and oats are both grown in the Austin area in the year that alfalfa is sown. The usual practice is to seed alfalfa in the fall without a nurse crop. As grain follows cotton in the rotation, fall-sown wheat

TABLE 19.—*Improved cropping system for 80-acre cotton farms, when fully developed for irrigation*

Item	Area I	Area II–A	Area II–B
	Acres	*Acres*	*Acres*
Cotton	38	34	34
Alfalfa for hay	22	25	25
Grain sorghum	8	8	8
Oats	7	0	0
Wheat	0	8	8
Farmstead and miscellaneous	5	5	5
Total	80	80	80

must be planted later than is desirable, and some farmers prefer to sow oats the following spring. In the budgets, the oat crop is used for area I, and wheat for areas II–A and II–B. In 1950, the oat crop was the predominant small grain in area I, while wheat was more commonly grown in the other areas.

Investments on these 80-acre units when fully developed are shown (table 20). The only changes from present investments are in the value of irrigation structures and in land. The increased value of land reflects the cost of additional leveling. Present buildings, fences, and machinery on most farms appear to be adequate for this system of farming.

TABLE 20.—*Investment on typical 80-acre cotton farms when fully developed for irrigation*

[Values based on "215" index] [1]

Item	Area I	Area II–A	Area II–B
	Dollars	*Dollars*	*Dollars*
Livestock [2]	150	150	150
Crop and feed inventory	20	20	20
Machinery [3]	2,905	2,905	2,905
Fences [4]	199	199	199
Buildings (excluding dwelling) [4]	1,151	1,151	1,151
Irrigation structures [4]	440	440	440
Domestic water system [4]	72	72	72
Land [5]	11,040	10,960	10,000
Total investment, excluding dwelling	15,977	15,897	14,937
Dwelling	4,100	4,100	4,100

[1] Based on United States average, 1910–14 = 100.
[2] Estimated on basis of numbers or values reported by farmers in survey.
[3] Calculated on basis of equipment needed for these farms (valued at 55 percent of cost new). It is assumed that machinery is half worn out, with allowance for salvage value (10 percent of new cost).
[4] Project average, adjusted for size of farm for irrigation structures, as there was no significant variation by areas.
[5] Value is farmers' estimate of dryland crop value plus average cost of land leveling as reported by farmers, adjusted to "215" index.

The reorganized farming system would mean a substantial increase in expenditures, particularly for fertilizers, insecticides, and costs of harvesting (table 21).

Increased yields, as a result of changes in rotation and improved practices (table 13), would increase net incomes substantially. Comparison of tables 18 and 21 indicates increases that range from 25 percent in area II–A to more than 100 percent in area I. These increases in income come mainly from increased production, which results from improved rotations, better irrigation practices, use of more fertilizer, and better insect control. Part of the large increase in area I is a result of developing for irrigation the 10 acres of land dry-farmed in 1952.

It is believed that in the long run, soils similar to those in area I will

respond better to fertilizers than those in areas II–A and II–B. It is also thought that a somewhat larger proportion of the acreage of these farms can be kept in cotton without reducing the long-run yields. Net returns (table 21) indicate the approximate level of income that farmers of average managerial ability might be expected to achieve with adequate irrigation water and normal growing conditions. Net income is calculated on the basis of owner-operators. Effect of renting on income is discussed in later sections.

Table 21.—*Receipts, expenses, and net income, 80-acre cotton farms, when fully developed and with improved rotations and practices*

[Prices and costs at "215" index]

Item	Area I	Area II–A	Area II–B
	Dollars	*Dollars*	*Dollars*
Receipts:			
Crops	9,818	7,539	7,894
Livestock	22	22	22
Total	9,840	7,561	7,916
Expenses:			
Fertilizers and insecticides	814	660	675
Custom work	2,658	1,924	2,033
Repairs, fuel, and oil	418	421	412
Depreciation	530	530	531
Taxes	119	119	112
Irrigation water, O and M	280	280	280
Miscellaneous	391	364	359
Total	5,210	4,298	4,402
Net farm income	4,630	3,263	3,514
Value of food furnished by farm	300	300	300
	4,930	3,563	3,814
Interest on investment [1]	799	795	747
Net return to operator for family labor and management	4,131	2,768	3,067
	Hours	*Hours*	*Hours*
Operator and family labor	1,667	1,854	1,880

[1] At the rate of 5 percent on total investment, excluding dwelling. (See table 20.)

Adoption of improved rotations and practices on these farms will not greatly increase the amount of work required of farmers and their families. The greater efficiency of labor that would result from leveling the land would probably offset the increased labor needed in applying fertilizer, and other improved practices. In the budgets, most of the additional work associated with higher production is hired; therefore it appears as an increased cost of custom work rather than as additional hours of work.

Cotton Farms with Additional Dry Land

Of the farms on the W. C. Austin Project with 60 to 99 acres of irrigable land, a third have less than 20 acres of nonirrigated land. Another third have from 20 to 99 acres.

With good management, the inclusion of 80 acres of dry land would increase net income sharply. The effect of adding 80 acres of dry cropland to an 80-acre irrigated farm in area II–B is examined in this section. It is assumed that 75 acres are cultivable, and that equal acreages of cotton, wheat, and alfalfa are grown. Yields are based on adoption of improved dry-farming practices, as previously discussed. Under these conditions, and "215" price relationships, the addition of 80 acres of dry land could be expected to increase the operator's labor and management income by about $1,600 a year (table 22).

TABLE 22.—*Effect on investment, expenses, and income of adding 80 acres of dry cropland to an 80-acre irrigated cotton farm in area II-B*
[Prices and costs at "215" index]

Item	80-acre irrigated unit	Additional for 80 acres of dry land	Total
	Dollars	*Dollars*	*Dollars*
Investment	14,937	6,400	21,336
Gross income [1]	8,216	3,253	11,469
Total expenses	4,402	1,336	5,738
Net farm income [2]	3,814	1,917	5,731
Interest on investment at 5 percent	747	320	1,067
Labor and management earnings	3,067	1,597	4,664
Labor:	*Hours*	*Hours*	*Hours*
Operator and family	1,880	930	2,810
Hired	----------	153	153
Total	1,880	1,083	2,963
Tractor use	359	325	684

[1] Total sales plus value of farm-grown food.
[2] Includes value of farm-grown food.

This substantial increase in income would result largely from the expanded use of family labor and the spreading of overhead costs. It should be possible to handle the additional acreage with little or no additional outlay for buildings or machinery. A family labor force of average size should be able to take care of the additional work, except for custom operations and part of the cotton hoeing in June, when about 150 man-hours might need to be hired.

With average management, further increases in size beyond a total of 160 acres would increase net income further, but 160 acres make reasonably full use of family labor and 2-row equipment. Acreage could not be expanded much more without additional investment in machinery.

Previously, it was pointed out that an 80-acre irrigated unit on class II–B soils should provide somewhat more income than is required for

a minimum adequate living under the price and management conditions assumed. But the income advantages from additional land are substantial. A minimum efficient size for a crop farm in this area is probably about 160 acres, if 80 acres are irrigable. The advantage of having the additional acreage would be even more apparent with moderately lower yields or prices.

To help visualize the relationship between projected prices and a recent year, total investment, income, and expenses for the same farm are shown (table 23). In this instance, prices paid were adjusted to

TABLE 23.—*Budgeted investment, income, and expenses for a 160-acre farm with 80 acres irrigable, area II-B*

Item	With projected prices [1]	With 1953 prices
	Dollars	*Dollars*
Expenses:		
Fertilizer and insecticides	830	1,056
Custom work	2,779	3,429
Repairs, fuel, and oil	549	746
Depreciation	531	735
Taxes	160	205
Irrigation water, O and M	280	395
Miscellaneous	609	776
Total	5,738	7,342
Inventory:		
Livestock and feed	170	190
Machinery	2,904	4,013
Fences, domestic water, and buildings except dwelling	1,422	1,985
Irrigation structures	440	614
Land	12,800	17,760
Land development	3,600	5,026
Total	21,336	29,588

Item	With projected prices [1]	With 1953 prices
	Dollars	*Dollars*
Receipts:		
Crops:		
Wheat	939	1,297
Grain sorghum	339	401
Alfalfa hay	2,139	3,315
Alfalfa seed	960	714
Cotton lint	5,137	7,093
Cottonseed	1,408	1,166
Livestock	22	25
Miscellaneous	225	326
Total	11,169	14,337
Receipts	11,169	14,337
Total expense	5,738	7,342
Net farm income	5,431	6,995
Value food from farm	300	323
Net income plus food	5,731	7,318
Interest on investment	1,067	1,478
Labor and management earnings	4,664	5,840

[1] Projected at a United States index of "215."

the average level of 1953. Prices received for crops represent average prices received by farmers for the last 6 months of 1953. For livestock products, the 1953 average price was used.[13]

In 1953, costs were considerably above the projected level, but prices received were above projected prices to an even greater extent. Thus,

[13] For products sold, the following prices were used: Wheat, bushel \$2.05; grain sorghum, hundredweight \$2.43; alfalfa hay, ton, baled, \$32.42; cotton lint, hundredweight \$29.26; cottonseed, ton \$60.42; alfalfa seed, hundredweight \$24.42; eggs, dozen \$0.42; chickens, live weight, pound \$0.18. (Preliminary estimates.)

1953 net income would have been higher than under projected price conditions. Most of the increase in income is due to higher prices for cotton lint and alfalfa hay. The price of hay in Oklahoma was abnormally high in 1953 because of the drought.

Potential Returns on a 240-Acre Crop Farm

Many farms on the W. C. Austin Project have more than 80 acres of irrigable land. Total acreage per farm in 1950 averaged 304 acres, with 132 acres irrigable.

An analysis is presented here of a 240-acre farm in area II–B with 160 acres of irrigable land. With the additional dry land, this farm gives reasonably full employment to operator and family labor. The additional dry land also makes use of 4-row field equipment economically feasible.

Organization of a 240-acre farm, with an improved rotation on irrigated and nonirrigated land, is shown (table 24). Livestock numbers assumed on this farm include 2 milk cows and 25 hens. As with previous budgets, livestock numbers are intended to represent approximate present numbers on crop farms.

TABLE 24.—*Improved cropping system for a 240-acre crop farm with 160 acres irrigable, area II-B*

Use of land	Irrigable	Nonirrigable	Total
For crops:	*Acres*	*Acres*	*Acres*
Cotton	68	13	81
Alfalfa, hay	50	0	50
Alfalfa, hay, and seed	0	13	13
Grain sorghum	16	0	16
Wheat	16	14	30
Total used for crops	150	40	190
Native pasture	0	27	27
Farmstead, ditches, and miscellaneous	10	13	23
Total	160	80	240

The following tabulation [14] shows average investment on a typical 240-acre farm with 160 acres irrigable, when completely developed, in area II–B, with prices and values at projected "215" index.

	Investment
Livestock	$295
Crop and feed inventory	47
Machinery	4,717
Fences	199
Buildings (excluding dwelling)	1,151
Irrigation structures	880
Domestic water system	72
Land	23,950
Total investment (excluding dwelling)	31,311
Dwelling	4,100

[14] For explanation of items listed, see footnotes to table 17.

These values are based on projected prices. Irrigated land is valued on the basis of dry cropland plus cost of development for irrigation.

An approximate 35-percent increase in investment in machinery over that required on an 80-acre irrigated farm is needed to operate this unit. In addition to the substitution of 4-row planters and cultivators for 2-row equipment, the larger farm has a pickup truck and second tractor. Need for the second tractor is limited to a few busy periods, and it is assumed that a rather old machine would serve the purpose. Acreage of grain on this farm is sufficient to justify ownership of a combine (on the basis of the costs and custom charges assumed). For the 63 acres of hay, custom baling would be more economical than owning and operating a baler.

Expected receipts and expenses on this farm, with improved practices, adequate water, and projected prices, are shown (table 25). A farm

TABLE 25.—*Receipts, expenses, and net income on a 240-acre crop farm with 160 acres irrigable, when fully developed, and with improved practices and rotation, area II-B*

[Prices at projected "215" index]

	Dollars		*Dollars*
Receipts:		Net farm income	8,125
Crops	17,581	Plus value of food furnished by farm	300
Livestock	133	Less interest on investment (5 percent)	1,600
Total	17,714		
Expenses:		Net return to operator for family labor and management	6,825
Fertilizer and insecticides	1,427	Charge for construction	240
Custom work	4,617		
Repairs, fuel, and oil	774		
Depreciation	992		
Taxes	240	Net return above construction cost	6,585
Irrigation water, O and M	560		
Miscellaneous	979		*Hours*
Total	9,589	Operator and family labor	2,446

unit similar to this one should return more than twice the net income of an 80-acre farm in area II–B. Under the assumed condition of prices and production, and allowing a return on investment of 5 percent, the net return per hour of family labor would be \$1.80 for the 80-acre farm, as compared with \$2.80 for the 240-acre farm. The increased earnings per man-hour for the 240-acre farm result from more efficient use of equipment and the larger amount of capital invested per man.

The number of hours of work required of the operator and his family on this unit would represent a reasonable level of employment. But distribution of the work would be uneven throughout the year. In only about 5 months of the year would a labor force equivalent to 1½ men be fully employed. Some labor, in addition to members of the family, would need to be hired in June and July for part of the cotton chopping, and in October and November for part of the cotton picking. Seasonal employment of family labor could be improved somewhat by adding a livestock enterprise.

A 160-Acre Farm with a Beef Herd

Interest in irrigated pastures and in production of livestock will probably increase in the next few years on the W. C. Austin Project and in similar areas. Continued surpluses of cotton, wheat, and feed grains would encourage the raising of forage crops. More legumes and grasses are needed in rotations on heavy soils to maintain structure. Most of the increased production of forage and pasture will probably be used for beef cattle, as local market outlets for additional dairy products are limited.

A budget is presented here for a 160-acre farm, 80 acres irrigable, with a beef herd of 74 cows. Calves are sold at about 475 pounds.

Few farmers in the area follow a program similar to this one. It was necessary to draw upon agronomists and animal-production specialists for estimates of pasture carrying capacity and beef production. These estimates are based on an adequate water supply; therefore they are higher than could be realized on the project at present.

A possible organization for a 160-acre beef-raising farm, with 80 acres irrigable, is shown in the following tabulation:

	Acres
Irrigated crops:	
Base pasture mixture (bromegrass, orchardgrass, Kentucky 31 fescue, perennial ryegrass, Madrid sweetclover)	33
Blue panic (*Panicum antidotale*) (overseeded with rye and vetch)	19
Alfalfa	23
Dryland crops:	
Wheat	25
Alfalfa, for hay and seed	25
Cotton	25
Farmstead and waste	10
Total	160

The base pasture grass is intended to provide all the grazing for the entire herd from early January to about mid-June, and part of the grazing in November and December. On a farm unit such as this, the base pasture grass would be divided into three fields to permit rotation grazing.

A pasture mixture suggested by local technicians consists of the following grasses:

	Pounds
Bromegrass	5
Orchardgrass	5
Kentucky 31 fescue	3
Perennial ryegrass	3
Madrid sweetclover	2

Other combinations might be equally satisfactory or, under some conditions, even preferable. Heavy fertilization would be necessary, including about 30 to 40 pounds of nitrogen and 40 pounds of P_2O_5 when the pasture is seeded, and annual applications of 300 pounds of 33–0–0. The stand of base pasture mixture should last about 5 years.

Blue panic *(Panicum antidotale)* seeded at the rate of 2 pounds per acre would provide all the grazing needed from mid-June to mid-October. By overseeding this pasture with rye and vetch, additional pasture would be provided in winter and spring. A stand of blue panic should last for 3 to 4 years. This grass is a heavy user of fertilizer. About

30 to 40 pounds of nitrogen and 40 pounds of P_2O_5 would be applied at seeding time. Annual applications of about 200 pounds of 0–20–0 and 300 pounds of 33–0–0 would be needed.

Irrigated alfalfa would provide aftermath grazing from October to December. About a half ton of hay would be needed per animal unit for supplemental feeding during storms or periods of short grazing. Fertilizer requirements for alfalfa would be about the same as those used in previous budgets.

TABLE 26.—*Estimated expenses and income on a 160-acre beef-raising farm, with projected prices* [1]

	Dollars		*Dollars*
Expenses:		Receipts:	
Fertilizer and insecticides	970	Wheat	551
Livestock expense including purchasing feed, spraying, hauling, and miscellaneous	497	Alfalfa hay	1,205
Custom work	819	Alfalfa seed	480
Repairs, fuel, and oil	510	Cotton	1,169
Depreciation	682	Cull cows	1,120
Taxes	166	Calves	4,854
Irrigation O and M	280	Miscellaneous	63
Miscellaneous	500	Total	9,442
Total	4,415	Net farm income (receipts minus expenses)	5,027
Total investment (except dwelling)	34,397	Plus value of food furnished by farm	300
			5,327
		Less interest on investment [2]	1,720
	Hours		
Total hours labor	2,517	Net labor and management earnings	3,607

[1] Projected at a United States index of "215".
[2] At 5 percent.

The livestock program assumed for this farm consists of producing calves on pasture to be sold at approximately 475 pounds. When they reach the age of 9, old cows would be replaced with heifers raised on the farm. If stock of the desired quality were available, it might be more profitable to buy replacement cows. It is estimated that with good management, a calf crop of 95 percent should be attainable with mature cows. For heifers, a calf crop of 75 percent is a reasonable expectation.

Estimated expenses and income from a 160-acre beef-raising farm are shown (table 26). Labor and management earnings of $3,607 may be compared with earnings of $4,664 for a 160-acre cotton farm with 80 acres irrigable (table 23). The total investment (excluding dwelling) for the beef-raising farm would be a little more than $34,000 (of which $12,000 would be in livestock) compared with about $21,000 for the cotton farm. The beef-raising farm would require about 2,500 hours of labor (including hired labor) compared with 2,750 on the cotton farm.

Effect of Limited Water Supply on Yields and Income

It was mentioned previously that a hydrologic study had been made to determine the probable frequency of water shortages on the W. C. Austin Project. Estimates were then made of the probable effects of these water shortages on crop yields.[15] In 16 of the 39 years from 1914 through 1952, water shortages would have affected crop yields somewhat. Years in which these shortages would have occurred tended to be bunched together. The longest dry period would have extended from 1930 through 1940, with some reduction in yields probable in each year except 1935. But apparently lack of water would not have reduced yields in any year from 1919 through 1929.

The 16 years of reduced yields would have included 5 years in which each of the 4 major crops—cotton, alfalfa, grain sorghum, and wheat—would have been affected. In 4 additional years, yields of cotton, alfalfa, and grain sorghum would have been reduced. Conditions in 4 years would have been adverse only for cotton and alfalfa; and in 1 year each, cotton and wheat, alfalfa and wheat, and alfalfa alone would have been affected. Yields of alfalfa would have been reduced in 16 years, cotton in 14, grain sorghum in 9, and wheat in 7.

Estimated reductions in yield in these dry years would reduce average yields for the 39 years by these percentages: Cotton, 10; alfalfa, 13; grain sorghum, 8; and wheat, 5.

Most of the calculated water shortages occur in the second half of the year.

The number of years from 1914 to 1952, in which a monthly water shortage of more than ½ inch would have occurred, is shown by months as follows:

	Years		*Years*
January	0	July	10
February	0	August	13
March	1	September	13
April	5	October	8
May	6	November	0
June	7	December	0

This tabulation suggests that, with the water supply on the project, early-maturing crops have a better chance of avoiding injury from drought than later crops. It also indicates that there are likely to be frequent years unfavorable for double cropping or fall seedings.

When, with improved practices and adequate water, yields on class II–B soils are adjusted to reflect a limited water supply similar to that on the W. C. Austin Project, incomes are reduced. For an 80-acre farm similar to the one budgeted previously, labor income would decline from $3 067 to $2,524.[16] The average decrease in yield in this case would be 10 percent, and it would result in an 18-percent decrease in net earnings.

Effect of Irrigation on Net Farm Income

Knowledge of the contribution made by irrigation water to increased net farm income is part of the information needed in deciding whether

[15] These estimates were made by Elmo Bauman, Soil Scientist, Soil Conservation Service, and Harold V. Eck, Assistant Professor, Agronomy Department, Oklahoma A. and M. College.

[16] With "215" price relationships.

an irrigation project is economically feasible. Calculations of this kind also provide a part of the basis for arriving at the amount farmers can afford to pay for water.

These calculations of costs and benefits must be interpreted with care. Sometimes these estimates may show only the increases in income that result from adding water, with associated practices, to an existing farm unit, or they may show the difference in income on two quite different types of farms. To show the net value of water, other investments associated with application of water should be permitted to share in the increased returns. This problem cannot be met adequately by charging market rates for use of all added resource inputs except water. One difficulty with comparisons of irrigated with dryland farming is that size of business is increased as a result of irrigation. This difference in scale may influence efficiency of operation. It is unlikely that the average farmer could increase his size of business, as measured by the investment and labor required, without reducing efficiency, at least for a few years while he is getting experience. Some farmers might not be able to manage additional resources successfully.

In this section, the productivity of water on a typical farm is compared with alternative forms of capital investment. The question to be answered is: How much better off would a farmer, capable of managing additional resources, be if he invested a given sum in irrigation and associated practices rather than in additional dry land with improved dry-farming practices? For this comparison, total investment is kept the same in the two alternative situations. It happens also that the number of hours of family labor required on the two farm units is about the same. The degree of managerial skill required of a farmer probably is closely associated with total investment and amount of work to be done. Thus, it can be assumed that the degrees of managerial ability required on these two alternative farm units are similar.

With this approach, the value of water is taken to be the difference between the income from irrigated and dry land that might be realized by a typical farmer with command over a given dollar amount of resources. This analysis is applied to one size and type of farm only, and to one soil area only. If the major purpose of the study had been to learn the value of water, additional analyses would have been made for other sizes and types of farms and other soil areas. The value of water would vary with soil productivity and possibly with size of farm.

Cost of construction of the project is not included as a farm investment, but in calculating farm income, repayments on construction are included with operation, maintenance, and other annual costs. Inclusion of the full annual construction charge may overstate the cost of irrigation water to some extent. On the W. C. Austin Project these charges run for only 40 years, and the estimated useful life of the project is longer than this. On most new irrigation projects, however, subsequent investments are required for drainage works, supplementary reservoirs, canal lining, and other purposes, and the total cost of water for the indefinite future may continue near the present level.

The comparison in this case is between the 240-acre farm with 160 acres irrigable developed previously and a dry farm with an equal total investment.[17] This comparable dryland unit would be a farm of about

[17] Irrigated land is valued at dryland value plus cost of development.

340 acres, with 291 acres of cropland. Prices are projected at the "215" index. Land use and the cropping system for this farm are shown in the following tabulation.

	Acres
Cropland:	
Cotton	97
Alfalfa, hay, and seed	97
Wheat	97
Total cropland	291
Native pasture	27
Farmstead and miscellaneous	22
Total	340

The rotation shown is an improved dryland rotation in area II–B. Improved practices are followed.

On the dry farm, investment in additional land is substituted for irrigation structures and land-development costs. The following tabulation [18] shows investments in various items.

	Value
Livestock	$295
Crop and feed inventory	47
Machinery	4,941
Fences	199
Buildings, excluding dwelling	1,151
Domestic water system	72
Land	24,799
Total investment (excluding dwelling)	31,504

Soils on this farm are similar to those in area II–B.

Investment in machinery on the dry farm is somewhat higher than that on the irrigated farm. The substitution possibilities indicated in the foregoing tabulation would be those that existed before an irrigation project was built and before any speculative value had become attached to irrigable land. Later generations of settlers might have to pay more for irrigable land relative to dry land. To that extent, they could substitute more acres of dry land for each acre of irrigable land, but the total investment would remain the same.

Estimated costs and returns for a 340-acre dryland cotton farm, with improved practices, are shown (table 27). The dry-farm unit shows a lower income than the irrigated farm but expenses also are lower, especially those for fertilizer and custom work.

The difference in net income, when allowance is made for the full cost of irrigation water (including construction), and interest and maintenance charges on development costs, amounts to about $693, or $4.33 per irrigable acre. Capitalized at 5 percent, this would represent a value of $87 per acre on the basis of the projected price level. Added to the average value of $80 for dry cropland in area II–B, and allowing for development costs of $55,[19] the potential value of irrigable land in this area (but with an adequate water supply) would appear to be $222 on the basis of productivity of water. The actual average value of irrigated land reported by farmers in area II–B, adjusted to the projected price

[18] For explanation of items, see table 17.

[19] Value reported by farmers in 1953 adjusted to the "215" price level.

TABLE 27.—*Receipts, expenses, and net income on a 340-acre dryland cotton farm, with improved rotation and practices* [1]

[Prices projected at "215" index]

	Dollars		Dollars
Receipts:		Net farm income	7,167
Crops	12,474	Plus value of food furnished by farm	300
Livestock	133	Less interest on investment at 5 percent	1,575
Total receipts	12,607		
Expenses:		Net return to operator for family labor and management	5,892
Fertilizer and insecticides	601		
Custom work	1,897		
Repairs, fuel, and oil	877		
Depreciation	733		
Taxes	236		Hours
Miscellaneous	1,096	Operator and family labor	2,443
Total	5,440		

[1] With soils similar to those in area II–B.

level, was $168. Farmers apparently allow for the limitations of their water supply.

This comparison indicates the *average* differences in returns between comparable irrigated and dryland farms. It does not allow for possible differences in *variability* of income under the two situations.

There may be other benefits from irrigation. For example, in some areas additional dryland may not be available to a farmer, and the addition of irrigation water may be the only feasible way to enlarge his farm business. Irrigation may increase the possible choice of enterprises, and thus improve distribution of labor, and flexibility of organization to meet changing conditions of demand.

Development of Irrigated Farms

Development of Land and Acquisition of Equipment

Of the 69 farmers interviewed on the W. C. Austin Project, 3 first received irrigation water in 1946, 16 in 1947, 19 in 1948, 20 in 1949, and the remaining 11 in 1950. As a group, they have had from 3 to 7 years in which to develop their farms. Expenditures for land development and for equipment have varied with the period in which water has been available.

Expenditures by years since the initiation of the project are shown for land development, structures, and buildings (table 28). By far the heaviest expenditure was for the leveling and bordering of land. As these operations are often done together, separate costs could not be obtained for them. By the spring of 1953, 6,397 acres of land had been leveled or bordered, or both, on the farms surveyed. There were 8,285 acres of irrigable land in the sample. Some farmers may have included light leveling or floating in their estimates, and these operations may have been repeated more than once on the same land. Many farmers had spread the leveling job over a period of years, rather than doing

TABLE 28.—*Cash outlays for land leveling and borders, irrigation structures, and buildings and improvements, by years, to date of survey, and planned project sample farms*

Item	1946–47	1948–49	1950–51	1952–53 [1]	Total	Additional expenditure planned
Irrigable land (1952) ---- acres					8,285	
Land leveling and bordering:						
Farms reporting ---- number	14	32	27	24		36
Contract ---- do	8	23	17	16		
Own labor ---- do	6	9	10	8		
Land leveled or bordered or both ---- acres	1,112	1,561	2,292	1,432	6,397	1,611
Cash cost ---- dollars	20,655	38,602	20,106	10,493	89,856	33,252
Cost per acre leveled ---- do	18.57	24.73	8.77	7.33	14.05	20.64
Irrigation structures:						
Farms reporting ---- number	8	27	7	2		9
Acres irrigated land ---- do	983	2,517	990	232	4,722	935
Cash cost ---- dollars	1,010	2,923	3,098	150	7,181	4,107
Cost per irrigable acre ---- do	1.03	1.16	3.13	.65	1.52	4.39
Buildings and improvements:						
Farms reporting ---- number	4	4	9	4		7
Irrigable land ---- acres	410	353	731	347	1,841	682
Cash cost ---- dollars	2,125	5,070	12,182	1,950	21,327	34,578
Cost per irrigable acre ---- do	5.18	14.36	16.66	5.62	11.58	50.69

[1] To time of survey, May 1953.

it all in the first year or two of irrigation. In 1953, more than half the farmers interviewed expected to level, in all, 1,611 acres of additional land.

Per-acre cost of land development was high in the early years of the project, partly because a good many level permanent borders were constructed. This method of preparing the land made it difficult to dispose of excess water in rainy periods. More recently, leveling of land has provided some slope to permit excess water to run off. Borders, when used, are not usually intended to be permanent. Anticipated cost per acre of additional land preparation is higher than the cost reported in the last 3 years. This indicates that development of lands most difficult to level has been postponed. Compared with some recent irrigation projects, present and contemplated costs of developing land are moderate (fig. 4). A third of the farmers who reported expenditures for land development said that this work was done with their own labor.

FIGURE 4.—Topography on the W. C. Austin Project is level to gently rolling, and the cost of developing land for irrigation is moderate. Part of the main canal of the project can be seen at the right. (United States Bureau of Reclamation photograph)

Outlays for irrigation structures have averaged about $1.52 per acre for farms reporting on the survey. This expenditure was spread quite evenly throughout the development period. Nine farmers said they planned to spend, on the average, an additional $4.39 per acre for irrigation structures. Farmers were asked to list their expenditures for buildings and improvements in the development period. These outlays may or may not be associated with irrigation development, but they are a part of the total amount of capital needed by farmers during the development period. Expenditures for these purposes were reported by less than a third of all farmers interviewed. On these farms, expendi-

TABLE 29.—*Number of survey farmers who reported special items of equipment needed in irrigation farming, W. C. Austin Project*

Item	Farmers owning equipment		Farmers renting equipment	Farmers borrowing equipment
	Single ownership	Joint ownership		
	Number	*Number*	*Number*	*Number*
Land levelers, and floats	18	8	7	14
Two-way plows	4			
Ditchers	19	2	15	9
Borderers	4			
Chisels	3		1	2
Shredders		2		1
Siphon tubes	58			2

tures averaged about $1,000 per farm. Only 7 farmers planned additional buildings and improvements; these would average about $5,000 per farm.

None of the outlays for land development and irrigation structures were made by tenants, although in a few cases tenants contributed labor.

Operation of an irrigated farm requires specialized equipment. On the W. C. Austin Project, special equipment commonly found on farms includes siphon tubes and tarpaulins, land levelers or floats, ditchers, and borderers. A few farmers have acquired two-way plows to eliminate difficulties caused by dead furrows, chisels for deep tillage, and stalk shredders to dispose of the heavy growth of irrigated cotton. Numbers of farmers who reported the major types of specialized equipment are shown (table 29). The extent to which equipment is jointly owned, rented, or borrowed is also shown.

Annual outlays per farm for irrigation equipment during development, and additional expenditures planned, are shown (table 30).

TABLE 30.—*Cash expenditures per survey farm for special equipment, by years to 1952; and expenditures planned; W. C. Austin Project*

Item	Before 1950	1950	1951	1952	Total	Additional expenditure planned	Total to date and planned
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Special tillage implements	25.72	14.49	13.26		53.47	100.35	153.82
Land levelers and floats	60.91	45.38	10.19		116.48	38.33	154.81
Ditchers	19.86	14.06	2.17	4.93	41.02	3.98	45.00
Borderers		3.48		4.64	8.12	13.77	21.89
Siphon tubes	71.03	55.10	8.38	13.46	147.97	19.10	167.07
Tarpaulins	21.59	9.45	.98	4.46	36.48	1.91	38.39
Miscellaneous equipment	.17	.55	.81	.32	1.85		1.85
Total	199.28	142.51	35.79	27.81	405.39	177.44	582.83

Financing Development on the Project

Development of the W. C. Austin Project occurred in a period of favorable farm incomes, and costs of development were met largely from farm income or from reserves. Apparently, extension of credit for such purposes has not been a problem. Of the 48 owners or part-owners who operated farms, 14 said they used credit to meet the costs of development. Twenty-eight used credit to meet operating expenses.[20] Only 8 of these farmers reported any indebtedness at the beginning of the development period. Average indebtedness at that time was $5,600 per farm reporting indebtedness.

Terms of loans made to farmers during the development period are shown (table 31). The rate of interest charged on bank loans reflects the risks associated with dry farming in this area. As irrigation demonstrates its ability to stabilize incomes, it should become possible to borrow on more favorable terms.

TABLE 31.—*Interest rate and term of loan for borrowed funds used per borrower during development period, survey farms, W. C. Austin Project*

Term of loan, and lender	Operators reporting	Average interest rate, per user	Average term of loans
	Number	*Percent*	*Years*
Short-term loans (1 year and under):			
Bank	23	8.8	0.6
Production Credit Association	4	5.0	.7
Intermediate (1 to 5 years):			
Bank	9	8.1	1.2
Production Credit Association	8	5.6	1.0
Insurance company	1	4.5	3.0
Individual	2	6.0	2.0
Other	2	6.0	1.0
Long-term loans (over 5 years):			
Bank	2	4.2	12.5
Insurance company	2	4.5	25.0
Farmers Home Administration	2	4.5	22.5
Individual	1	5.0	20.0
Other	3	4.0	23.3

Costs of Development and Repayment Ability— A Small Irrigated Farm

This section illustrates the costs of development that would be incurred on a typical farm. It shows how these costs would be spread over the development period and indicates how they might be repaid from income.

These relationships are shown for an 80-acre farm in area II–B.

[20] Of 21 tenants, 14 used credit to meet operating expenses. (Use of credit by landlords was not studied.)

About 18 percent of the farms on the project contain 100 acres or fewer, including acres of nonirrigated land. Financing outlays for farm development would be more of a problem on units of this size than on larger farms. The effect on repayment ability of an additional 80 acres of dry land is also indicated.

Costs of development by years for owner-operated farms in the survey which first received water in 1948 or 1949 are shown (table 32). The borrowing and repayment of funds for all farm purposes during the development period are also shown.

TABLE 32.—*Outlays for irrigation equipment and land development, and use of credit for all farming purposes, by development years, 17 owner-operated farms that first received water in 1948 or 1949, W. C. Austin Project* [1]

Item	Year of development					Total to date	Additional outlays needed
	1st	2d	3d	4th	5th		
Outlay for irrigation equipment:							
Farms reporting..number..	14	7	6	2	1	......	6
Average per farm [2]..dollars..	199	92	58	7	1	357	93
Outlay for land development:							
Farms reporting..number..	16	7	6	4	2	......	11
Average per farm [2]..dollars..	662	192	170	76	42	1,142	305
Total equipment and development outlays per farm.....dollars..	861	284	228	83	43	1,499	398
Number of farms using credit..............number..	7	5	7	6	4	......	....
Amount borrowed per farm [2]..............dollars..	1,131	821	876	865	291	3,984	....
Amount repaid per farm [2]..............dollars..	945	827	883	946	298	3,899	....

[1] Average irrigable acres per farm = 98. Average total acres = 156.
[2] Average of all 17 farms.

In this analysis, an accelerated rate of development is assumed, with development to be completed in 7 years. With this plan, a third of the land would be leveled and seeded to alfalfa the first year. An additional third would be leveled and seeded to alfalfa in the fourth year when the old alfalfa is plowed up. The leveling program would be completed in the seventh year. Under some circumstances, it might be desirable to complete the leveling earlier. On some farms it might be well to complete it in the first year. The optimum rate of leveling depends partly on whether satisfactory irrigation can be carried on without leveling. The program assumed in this example is suitable for land that is not so rolling or uneven that row crops and small grains cannot be watered with a reasonable degree of success. Alfalfa is more

difficult to water, and with the procedure assumed here, leveling is tied to the alfalfa sequence in the rotation. This pattern reflects the actual practice of some farmers on the project.

It is assumed that outlays for permanent structures, turnouts, drops, and the like would follow the same pattern as leveling. Irrigation equipment and special machinery needed for an irrigated farm would be bought in the first year. It is assumed that other farm equipment, buildings, and improvements were adequate at the beginning of the development period.

It was difficult to estimate the probable trend in yields during the development program. The wide fluctuations in past yields on the project furnish no basis for projecting them through the development period. It was necessary to use estimates based on the effect of increasing the acreage of alfalfa in the rotation, improved water distribution as a result of leveling, and the rate at which farmers could reasonably be expected to master new techniques. Yields assumed for each year of the development period are shown (table 33). Improved yields shown for the first year of development reflect improved practices, and increases in the fifth and eighth years are shown for crops planted on alfalfa ground. In calculating farm expenses, the cost of fertilizer and other costs that vary with yields are adjusted to the yields used.

TABLE 33.—*Projected yields through the development period, with assumed rotation and practices, land area II-B*

Crop	Average irrigation yield, W. C. Austin Project 1946–52 [1]	Year of development [2]							
		1st	2d	3d	4th	5th	6th	7th	8th
Cotton, lint..pounds..	375	447	447	447	447	590	590	590	590
Wheat.......bushels..	17	22	22	22	22	22	22	22	33
Grain sorghum...cwt..	15	18.5	18.5	18.5	18.5	18.5	18.5	18.5	25.5
Alfalfa..........tons..	2.2	.....	3.8	3.8	3.8	3.8	3.8	3.8	3.8

[1] Estimated for land area II–B on basis of actual project average yields.

[2] Improved yields first year of development period, resulting from improved practices not associated with development. Also, development yields are based on an adequate water supply. Yield increases in fifth and eighth years follow planting of crops on land previously in alfalfa.

For each year of the development period, an *operator's equity income* was calculated. This is net income plus value of farm-raised food, minus interest on half the working capital and on a mortgage debt of $5,000.[21] Interest was charged at 6 percent on working capital and 5 percent on mortgage indebtedness. An allowance of $2,045 was made for living costs, and the surplus was considered available to repay capital

[21] This indebtedness, which remains constant throughout the development period, is a little less than half the total investment at the beginning of the period.

outlays. The basis for calculating the living allowance has been explained earlier in this circular (p. 33).

Progress in farm development, as reflected by capital outlays, annual income, and repayment of debt, is indicated in table 34 and figure 5. In figure 5, cumulative totals are shown for farm-development outlays and cumulative earnings available for debt retirement in each year of the development period. These calculations were based on a parity price relationship at the "215" index level.

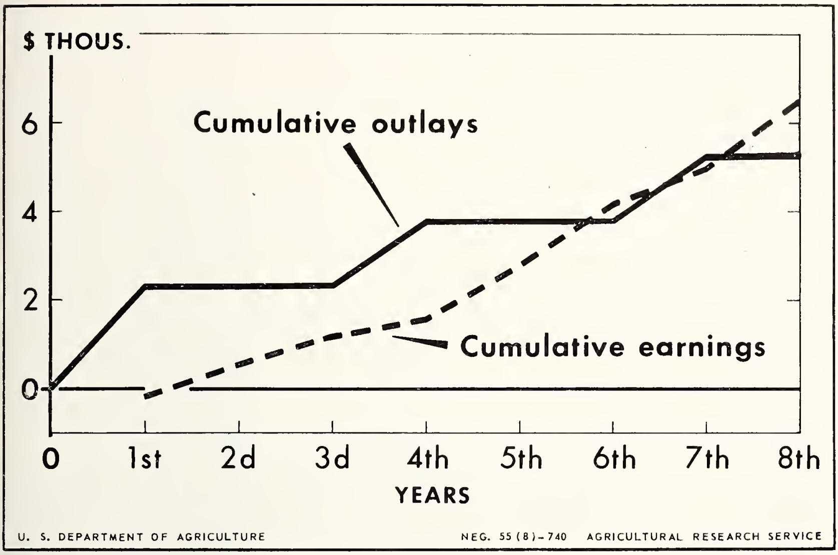

FIGURE 5.—Cumulative farm development outlays and earnings available for repayment, 80-acre farm, area II-B, "215" prices.

Under assumed conditions, it appears that an owner-operated farm of this size and type could both provide an adequate family living and repay the costs of irrigation development in 8 years. In the eighth year, repayment of project construction charges could be begun. On the W. C. Austin Project, these charges would amount to $120 a year for a farm of this size.

The asset value of this farm would increase during the development period. Also, it might not be necessary to repay all costs of development before beginning to repay construction charges. But only limited sources of long-term credit are generally available to farmers for the types of investment involved in farm development. It would therefore appear to be more realistic for these outlays to be repaid before payments on project construction costs are begun.

Operators of farms of this size, which have a smaller indebtedness, or of larger farms, would be able to begin repayment of construction costs earlier.

Variations in prices and in yields affect a farmer's ability to repay

TABLE 34.—*Capital outlays for farm development, income, and earnings available for repayment of development loans year-by-year in the development period* [1]

[Prices projected at "215" index]

Item	Year of development							
	1st	2d	3d	4th	5th	6th	7th	8th
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Capital outlay:								
Machinery	842	0	0	0	0	0	0	0
Structures	266	0	0	266	0	0	266	0
Land development	1,200	0	0	1,200	0	0	1,200	0
Total	2,308	0	0	1,466	0	0	1,466	0
Operator's equity earnings [2]	1,875	2,707	2,707	2,442	3,277	3,277	2,989	3,535
Allowance for living expenses [3]	2,045	2,045	2,045	2,045	2,045	2,045	2,045	2,045
Net earnings available for investment	−170	662	662	397	1,232	1,232	944	1,490
Development loans outstanding at end of year	2,478	1,878	1,326	2,478	1,343	209	772	0
Interest [4]	62	110	83	97	98	41	26	0
Total development loans and interest outstanding at end of year	2,540	1,988	1,409	2,575	1,441	250	798	0

[1] Assumes that development of farm for irrigation is financed by loans.

[2] After deducting interest on indebtedness equal to half of working capital and a $5,000 mortgage. No charge included for project irrigation construction costs.

[3] Including perquisites, except rental value of dwelling.

[4] At 5 percent on average amount of development loans outstanding.

TABLE 35.—*Ability to repay farm-development costs with 80 acres irrigable and 80 acres dry land, class II-B*

[Average of prices received = 90 percent of "215" index]

Item	Year of development							
	1st	2d	3d	4th	5th	6th	7th	8th
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Net return above living costs	511	1,263	1,263	908	1,720	1,720	1,432	1,933
Cumulative amount of development costs above repayments [1]	1,854	620	0	874	0	0	0	0
Cumulative cash surplus above development costs	0	0	643	0	846	1,709	2,043	0

[1] Including interest on balance outstanding.

the costs of developing his farm. A moderate decline in either prices or yield would greatly lengthen the repayment period. This is illustrated, for prices, by calculating the number of years required to repay the costs of developing an 80-acre farm, with prices for farm products reduced by 5 and 10 percent, but with no change in costs. If prices received averaged 95 percent of the "215" index level in the development period, repayment would not be completed until the 11th year. An additional reduction of prices received to 90 percent would extend the repayment period into the 19th year. These calculations allow for random fluctuation about these prices during the development period, but they assume no trend. If average prices were as stated, but were to trend downward during the period, additional time would be needed for repayment, because development costs incurred in the earlier years at a higher price level would be repaid when prices were lower.

A price relationship more favorable than the "215" level would make it possible to begin repayment of construction costs during the farm-development period. Any reductions in prices received would extend the repayment period at an increasing rate. A 5-percent reduction in prices would increase the number of years required for repayment by 38 percent. An additional reduction of 5 percentage points would lead to a further increase of 73 percent in number of years required for repayment.

How Adding Dry Land Affects Repayment Ability

Adding 80 acres of dry land increases ability to repay, and it shortens the repayment period. In the analysis that follows, it is assumed that the additional dry land is comparable in quality to land class II–B; that 75 acres of it are cultivable; and that equal acreages of cotton, wheat, and alfalfa are grown. An additional indebtedness equal to the value of the additional resources is assumed. Repayment ability during the development period of a farm with 80 acres irrigable and 80 acres of dry land is shown (table 35). Prices received in this instance are assumed to be 90 percent of the "215" level. The addition of 80 acres of dry cropland could be expected to increase net income by about $1,235 a year.[22] After allowing for living costs, sufficient income could be accumulated to repay costs of farm development after the fourth year. Funds would be available to provide for repayment of project construction costs beginning in the fifth year. With prices at the "215" level, farm development costs after the second year could be financed from current income. The advantage of having the additional land is apparent when the effect upon rate of capital accumulation is considered, particularly under conditions of adverse prices.

How Tenure Affects Repayment of Development Costs

The previous analysis applies to an owner-operated farm. The 160-acre farm with 80 acres irrigated is further analyzed to see how quickly landlords and tenants might repay typical development costs from their respective shares of earnings.

Based upon customary rental shares on the W. C. Austin Project (see table 7), tenant and landlord shares of income and expense are shown

[22] With prices at the "215" level, the increase in income would be $1,597.

(table 36) for each year of a development period. Neither farm nor project costs of development are included in operating expenses, as the objective is to show income available to pay development costs. Yields in the development period are the same as previously assumed. When the landlord's costs are considered, it becomes necessary to include the cost of maintaining a farm dwelling. Therefore, total farm incomes and expenses shown in this table differ from those shown in previous tables by the addition of $255 of dwelling costs for the landlord and the same amount of perquisite income for the tenant. For total farm *net* income, these items cancel out.

As a rule, expenditures for irrigation structures and land leveling on the W. C. Austin Project are paid by the landlord. He usually pays for all alfalfa seed also. The tenant's costs that are associated with irrigation development include charges for siphon tubes, tarpaulins, and any special machinery he may need. Income of both landlord and tenant would be reduced if heavy leveling of land reduced yields the following year. As cuts and fills from leveling are moderate on the W. C. Austin Project, they should not affect yields appreciably.

Estimated landlord's net income and costs of development by years for a 160-acre farm with 80 acres of irrigable land are shown (table 37). With projected yields, the landlord's income would rise rapidly. Under the assumed conditions, 9 years would be needed in which to repay costs of developing the farm from increased earnings (without allowing for project construction costs). As these are costs of permanent improvements, they could be amortized over the life of the improvements if adequate financing were available. The increase in income that would result from irrigation should be adequate to carry both interest and amortization of land development and to permit repayments of project construction costs to begin after the first year.

With a decrease of 10 percent in average prices received, and no change in prices paid, costs of developing the farm could not be repaid from increased income until the 26th year. Funds would not be available from increased earnings to begin repayment of district construction charges until the 6th year (if farm-development costs were amortized).

Expenditures of the tenant on a farm of this size for irrigation equipment are shown (table 38). Also shown is the tenant's income. Under the conditions assumed, a tenant should be able to repay his investment in irrigation equipment in 2 years. But if prices received were to decline by 10 percent, he could not repay this investment from earnings for 8 years. Apparently, a unit of this size does not provide enough income to give a tenant more than a narrow margin of safety above living costs. These living costs, however, are not intended to be an absolute minimum, and an average family should be able to adjust them in occasional bad years.

The landlord's net income would increase about 74 percent in the development period, while the tenant's income would increase by about 38 percent. The tenant would bear only about 16 percent of the cost of development; but his regular expenses (for fertilizer, insecticides, and harvesting) would increase. Also, the increases in yield that are shown imply that production practices would improve during the development period, and this would represent an increased managerial contribution by the tenant.

TABLE 36.—*Landlord and tenant incomes and expenses in a 7-year development period, under 2 assumed price levels, 160-acre farm with 80 acres irrigable, land area II-B*

NET INCOME WITH "215" PRICE RELATIONSHIP [1]

Item	Year of development							
	1st	2d	3d	4th	5th	6th	7th	8th
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Total farm income, including perquisites	9,305	10,104	10,104	10,104	11,448	11,448	11,448	11,683
Landlord income	2,646	2,938	2,938	2,938	3,274	3,274	3,274	3,352
Tenant income	6,659	7,166	7,166	7,166	8,174	8,174	8,174	8,331
Total expenses	4,132	5,812	5,812	6,077	6,379	6,379	6,667	6,563
Landlord	1,723	1,568	1,568	1,768	1,641	1,641	1,846	1,746
Tenant	2,409	4,244	4,244	4,309	4,738	4,738	4,821	4,817
Net farm income (including perquisites)	3,460	4,292	4,292	4,027	5,069	5,069	4,781	5,120
Landlord	923	1,370	1,370	1,170	1,633	1,633	1,428	1,606
Tenant	2,537	2,922	2,922	2,857	3,436	3,436	3,353	3,514
Cash	1,982	2,367	2,367	2,302	2,881	2,881	2,798	2,959
Perquisites	555	555	555	555	555	555	555	555

NET INCOME WITH PRICES RECEIVED AT 90 PERCENT OF "215" LEVEL [2]

Item	1st	2d	3d	4th	5th	6th	7th	8th
Landlord	658	1,076	1,076	876	1,306	1,306	1,101	1,271
Tenant	1,927	2,261	2,261	2,196	2,674	2,674	2,591	2,736

[1] Assumes that both prices received and prices paid are at a United States index of "215"; 1910–14 = 100.

[2] Assumes that prices paid are at a "215" index, but prices received are at 90 percent of a "215" index, or an index of 194.5. This gives a parity ratio (prices received to prices paid) of 90 percent.

TABLE 37.—*Landlord's expenditures for land development, and rate at which development loans can be repaid from increased income during the development period, 160-acre farm with 80 acres irrigable, land area II-B*

[Prices received and paid at a "215" index]

Item	Prior to irrigation	Year of development								
		1st	2d	3d	4th	5th	6th	7th	8th	9th
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Capital outlay for land development [1]	0	1,466	0	0	1,466	0	0	1,466	0	0
Landlord's net farm income [2]	920	923	1,370	1,370	1,170	1,633	1,633	1,428	1,606	0
Increase over income prior to irrigation		3	450	450	250	713	713	508	686	686
Farm development loans outstanding at end of year		1,463	1,049	663	1,923	1,276	645	1,653	1,026	408
Interest on development loans		36	64	44	66	82	50	59	68	38
Total loans plus interest outstanding		1,499	1,113	707	1,989	1,358	695	1,712	1,094	446

[1] Includes irrigation structures for the farm.

[2] After deducting interest at 5 percent on real-estate mortgage indebtedness of $10,400 carried throughout development period. Assumes development is financed by loans.

TABLE 38.—*Tenant's expenditures for irrigation equipment, and income during the development period, 160-acre farm with 80 acres irrigable, land area II-B*

[Prices received and prices paid at "215" index]

Item	Year of development							
	1st	2d	3d	4th	5th	6th	7th	8th
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Capital outlay for irrigation equipment	842	0	0	0	0	0	0	0
Tenant's net income, including perquisites [1]	2,537	2,922	2,922	2,857	3,436	3,436	3,353	3,514
Allowance for living expenses, including value of perquisites	2,295	2,295	2,295	2,295	2,295	2,295	2,295	2,295
Income available for investment in irrigation equipment	242	627	627	562	1,141	1,141	1,058	1,219
Irrigation equipment cost outstanding at end of year	600	0	0	0	0	0	0	0
Interest	15	0	0	0	0	0	0	0
Total outstanding, including interest	615	0	0	0	0	0	0	0

[1] After deducting interest on a chattel mortgage of $1,000 at 5 percent, and on half the working capital borrowed each year at 6 percent.

Further Economic Analyses Needed

The study reported here did not cover all the important economic aspects of development of irrigated farms in a subhumid area. There remain several problems on which additional research is needed. These are:

1. The effect of irrigation upon stability of incomes, to determine whether irrigation merely raises the level of income or whether it also reduces the variation in income from year to year.

2. Analysis of returns from a farming system based on "full" water use per acre compared with returns from a system based on the concept of "supplemental irrigation." The latter system implies use of irrigation to supplement rainfall in dry years. In effect, it means little change from existing dryland systems and practices. With an unreliable water supply, it might be desirable to concentrate on forage crops for livestock feed rather than on cash crops, since forage may be more dependable than grain in the drier seasons.

3. Analysis of use of a given supply of irrigation water, to provide either a firm water supply to a small acreage or a more uncertain supply to a larger acreage. Such an analysis would indicate the relative economic benefits to the area as a whole.

4. Analysis of the most economical rate of development of the project, with emphasis on the need for, and the availability of, credit for developing irrigation farms.

5. Further analysis of the place of irrigated pastures and livestock systems on irrigated farms in areas similar to the W. C. Austin area. Production and market possibilities of potatoes, sweetpotatoes, lettuce, and other specialty crops should also be investigated. For projects with limited water supplies, a worthwhile analysis could be made of the most profitable way to ration water among the crops grown.

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Appendix

Sampling Procedure for Farm Survey

On the basis of Bureau of Reclamation and former Production and Marketing Administration data, the 341 irrigated farms for which complete data on operating units could be obtained were arrayed by acres of irrigable land. Thirteen farms were omitted because these data were not available. Farms within irrigable land size groups were further arrayed by acreages of dry land. Farms with more than 480 acres of dry land were eliminated from the universe of farms to be sampled.

These arrays were subdivided according to the three major soil areas on the project. For each important irrigable-acreage size group, farms were arrayed by Bureau of Reclamation tract number. Eight farms were drawn at random for survey interviews.[25] Size groups thus sampled are shown (table 39).

Table 39.—*Farms sampled, by irrigable-acreage size groups*

Land class area	Irrigable land	Farms sampled [1]
	Acres	*Number*
I	20–59	9
	60–99	9
	100–179	8
II–A	60–99	8
	100–179	7
II–B	60–99	8
	100–179	8
	180–379	10

[1] Records were taken on 2 additional farms in the 180–379 acre group, but 1 was subsequently classified as in land area I and the other in land area II–A.

[24] Publication may not be easily obtained.

[25] Survey schedules were obtained on 69 farms. Farms with more than 1 tract were arrayed by the lowest tract number.

When a survey schedule could not be obtained for a sample farm, an alternate was chosen by drawing the farm with the next higher irrigated tract number. If a schedule could not be obtained on this farm, the farm with a number next lower than that of the original farm chosen was taken. Tract numbers were assigned in series to each quarter section, starting in the northeast corner of the project and proceeding back and forth in a serpentine manner. Tracts within quarter sections were given subscript numbers. As a result, each alternate selected was in the same locality as the original sample farm.

Assumptions Used in Budgeting

Labor requirements.—Labor requirements, by months, for crops and livestock were taken from secondary sources of information. An additional allowance was made to cover time lost because of inclement weather and breakdown and servicing of machines, and to cover such overhead jobs as construction and repair of buildings, fences and ditches, farm business, and other miscellaneous work. Information on indirect labor requirements is not available for Oklahoma. However, a detailed cost study in central Illinois in 1951 indicated that indirect labor was equal to the following percentages of crop and livestock labor.

Kind of farm:	*Percent*
Grain	36
Hog	34
Feeder cattle—hog	40

It is assumed that on irrigated farms in Oklahoma, indirect labor would amount to 25 percent of direct-labor requirements. Of this amount, 15 percentage points are added to cover time lost in the field, emergency repairs to equipment, and a part of the time spent on farm business, machinery, and fences. This increment is distributed throughout the year in the same proportion as direct labor. The other 10 percentage points are added to provide for overhauls, repairs, maintenance, and miscellaneous activities; it is assumed that this work can be done in slack times.

It is also assumed that a farm operator will work a maximum of 240 hours each month, and that family labor will be available to the extent of 120 man-hours per month in the 3 summer months and 70 hours per month in others.

Operator and family labor supply.—No recent information on hours worked by Oklahoma farmers is available. A recent summary of Illinois studies (*10*) indicates that in the areas studied, farmers averaged from 191 to 244 hours of labor a month, or 2,292 to 2,928 hours a year (table 40). The amount of work done per man-year varies with the number of livestock carried. It is assumed that an average field-crop farmer in the W. C. Austin area might work a total of 2,400 hours a year.

Values of buildings, machinery, and improvements.—Investment values used in the budgets reflect the useful value of the improvement for the type of farming assumed. Present values of buildings and improvements, as reported in the survey, were adjusted to the "215" price level and used in the budgets. As building values did not vary significantly by size of farm, the average for all farms was used. Kinds and sizes of machines needed on each farm were determined, and values were assigned on the basis of cost new at "215" prices, less depreciation.

Present value is assumed to represent average investment during a period of years, or 55 percent of new cost (cost new, half depreciated, with a salvage value of 10 percent). Depreciation was calculated on a straight-line basis.

Only half the value of the domestic and livestock water system is included in farm investment. Dwelling is not included as a farm investment except when comparison is made between landlord and tenant incomes. Cost of maintaining the dwelling and rental value of housing are also omitted except in the landlord-tenant comparison

TABLE 40.—*Hours worked per man per month, selected Illinois farms* [1]

Section, type of farm, and years	Crop acres per farm	Labor per man per month
	Acres	*Hours*
Champaign and Piatt Counties:		
(Cash-grain farms)		
1923–27	235	233
1928–32	230	232
1933–37	224	201
1938–42	238	198
1943–47	253	199
Western Illinois:		
(Cash-grain—feeder-cattle—hog farms)		
1948	172	216
1949	175	226
Northwestern Illinois:		
(Dairy—hog—feeder-cattle farms)		
1949	123	237
1950	128	244
Central Illinois:		
(Cash-grain—feeder-cattle—hog farms)		
1951	212	191

[1] Hours worked increase as importance of livestock increases. In this study, 16 farms hired year-round men. They worked an average of 174 hours per month, or 2,091 hours per year.

Land values and costs of irrigation development.—Values of cropland and pasture used in the budgets are the average values of dry land for each land class, adjusted to the "215" price level. For irrigated land at present development, average expenditures for land leveling and bordering were added to the value of dry land.

For budgets of fully developed farms, allowance was made for additional leveling of land and for irrigation structures. Expenditures required for complete development are shown (appendix table 49). They are based on estimates prepared by the Soil Conservation Service (7), adjusted to the "215" price level.

Tenure and indebtedness.—Aside from the analysis of farm development, budgets are presented on the assumption that a farm is owner-operated and free of debt except for working capital. It is assumed that half the operating funds needed during the year will be borrowed. Operating loans are assumed to run for an average of 6 months, with an interest rate of 6 percent.

The objective in analyzing the development period is to show how many years are required for a typical farmer to repay the costs of development from earnings. In order to make this a conservative estimate, some indebtedness is assumed. For the 80-acre unit, a real estate mortgage of $4,000 and a chattel mortgage of $1,000 are assumed to be carried throughout the development period. Interest on each of these is charged at 5 percent. Indebtedness represents about a third of the average value of the real estate, including dwelling, and a third of the value of working assets.

When 80 acres of dry land are added to this unit, indebtedness is increased by the value of the added resources, or $6,400. This assumption is followed to illustrate the additional income that could be realized by the present operator of an 80-acre farm by adding to his land resources.

Income.—For "present" and "improved" farm budgets, two income measures are shown in the budget summaries: (1) Net farm income, and (2) net return to family labor and management. The first of these is the difference between receipts, excluding perquisites, and expenses, including depreciation and irrigation operation and maintenance, but excluding irrigation construction charges. Interest is charged only on working capital borrowed. The second includes an estimate of $300 for perquisites, except housing, and it includes in expenses interest on the entire investment at 5 percent. No charge is allowed for family labor. The returns to labor and management shown here are based on values of dry land. They would be realized only by owner-operators who held land before the effects on income of irrigation had become partially capitalized into land values.

For owner-operator development budgets, net farm income is shown as before, but operator's income is calculated as "farm family equity earnings." In these budgets, interest is charged on all funds assumed to be borrowed. In other respects it is the same as "net return to family labor and management."

On tenant-operated budgets, value of housing is included as a perquisite and cost of housing as a cost. These values are assumed to be equal; therefore they cancel out when net farm income is calculated.

Crop Rotations, Yields, and Fertilizer Requirements

Yields of irrigated crops were obtained from farm operators for the crop year 1952 by land classes. These yields were weighted by the areas in the different land classes and adjusted to the project average yield for 1946-52 to find the present irrigated crop yields.

Present crop yields on dry land in the different land classes were based on estimates of yield from agricultural technicians in the W. C. Austin area. These estimates of yield were adjusted by the total 1946-52 average yields on dry land in the project.

Estimates of yield for irrigated and dryland crops were made for two future conditions, to be achieved within the next 10 years—one for 5 to 10 percent of the farm operators, and the other for 75 percent of the operators.

Yields for various irrigated crops were estimated as follows for the first of these assumed conditions: Favorable price relationship, unrestricted water supply, and a high level of management by farm operators.

In this instance, a high level of management is taken to mean proper irrigation and tillage practices and also optimum insect-control practices, fertilizer application, and harvesting methods. These factors were regarded as comprising the optimum future condition that would be obtained by 5 to 10 percent of the farm operators within the next 10 years. In arriving at estimates of yields for this optimum future condition, technicians in the field were guided by the yields obtained by a relatively small percentage of the present operators. Crop rotations, fertilizer applications, and associated costs to obtain these yields and to maintain soil fertility were then developed.

Table 41.—*Nutrient content of specified crops* [1]

Crop	Yield	Part of crop	N	P_2O_5	K_2O
			Pounds	*Pounds*	*Pounds*
Cotton	500 pounds; 1,000 pounds; 1,500 pounds	Lint; Seed	38	18	14
		Burs, leaves, and stalks	27	7	36
		All	65	25	50
Alfalfa	3 tons	All	140	35	135
Grain sorghum	30 bushels	All	84	29	90
Oats	50 bushels	Grain	35	15	10
	1.25 tons	Straw	15	5	35
		All	50	20	45
Wheat	30 bushels	Grain	35	16	9
	1.25 tons	Straw	15	4	21
		All	50	20	30

[1] See (*2*) and (*3*).

With additional experimental data, continued technical assistance, extension work in the area, and a favorable price relationship, technicians thought that within 10 years 75 percent of the farm operators could be expected to approximate yields halfway between present yields and yields under optimum conditions. Yields for this set of conditions were determined, and crop rotation, fertilizer applications, and associated costs necessary to obtain these yields and to maintain soil fertility were worked out. These conditions are referred to subsequently as "intermediate conditions."

For this area, little experimental data are available with which to relate application of fertilizer to yields. It was assumed that the soils in the area would maintain certain yields without the addition of fertilizer. These yields were: Cotton 125 pounds lint, alfalfa 1½ tons, grain sorghum 900 pounds, oats 17 bushels, and wheat 10 bushels.

Because of the need for readily available plant nutrients at high yields, complete restoration of plant nutrients removed by the crop was made for the following yields: Cotton 1,000 pounds, alfalfa 8 tons, grain sorghum 4,000 pounds, oats 80 bushels, and wheat 40 bushels. The quantity of plant nutrients that would be needed to replace all those removed by the crop was based on the nutrient content of crops as shown in table 41.

To find the quantities of crop nutrients to be replaced, an allowance was made for crop residue (that part of the crop not removed). Consideration was given to the probability that some nutrients were not readily available, to losses of plant nutrients from leaching, and so on. Plant nutrients contained in the portions of various crops removed are shown in table 42 for specified yields.

TABLE 42.—*Major plant nutrients, except potash, contained in the part of crop removed* [1]

Crop	Yield	N	P_2O_5
		Pounds	*Pounds*
Cotton	500 pounds	50	21
Alfalfa	3 tons	140	35
Grain sorghum	30 bushels	52	21
Oats	50 bushels	39	17
Wheat	30 bushels	39	17

[1] Potash not shown, as it is not considered necessary to replace it to maintain fertility.

The quantity of plant nutrients that would need to be replaced to maintain soil fertility for various yields was based on a straight-line relationship between yields when no plant nutrients were replaced, and yields when all plant nutrients, loss of which would limit yield, were replaced.

It was assumed that 3 years of alfalfa would provide all the nitrogen for the following crop and half the nitrogen for the second crop. Depending on yields, some additional nitrogen may be needed for the crops that follow alfalfa after the first 2 years. In some instances, however, there may be a carryover of nitrogen beyond the first 2 years. Because of the nitrogen-fixing ability of alfalfa, only starter nitrogen and phosphate were used for this crop. Replacing soil nutrients for given yields to maintain soil fertility is done on the assumption that the present level of soil nutrients and the physical structure of the soil are such that the yields are obtainable. No allowance is made for building up a soil with low fertility and poor physical structure. Soil tests for the area indicate that even with high yields a potash deficiency is not likely to develop in the near future. Therefore, it was considered unnecessary to replace potash to maintain soil fertility.

A possible dryland and irrigated rotation for a predominately cotton farm for each soil area, estimated average yields for years in the rotation,

Table 43.—*Crop rotation (cotton), yield, and fertilizer requirement by soil areas, intermediate conditions*

Soil area	Irrigated or dryland	Crop	Years in rotation	Percentage of cropland each year	Average yield	Average fertilizer requirements per year [1] N	P₂O₅	K₂O
			Number	*Percent*		*Pounds*	*Pounds*	*Pounds*
I	Irrigated	Alfalfa	3	30	4.6 tons	[2] 5	46	0
		Grain sorghum	1	10	27.5 cwt	0	27	0
		Cotton	5	50	1.42 bales	60	28	0
		Wheat	1	10	39.0 bushels	51	22	0
	Dryland	Alfalfa	3	27	1.4 tons	[2] 5	11	0
		Alfalfa seed			1.2 cwt.[3]			
		Grain sorghum	2	18	15.0 cwt	5	11	0
		Cotton	5	46	0.53 bales	16	8	0
		Wheat	1	9	17.0 bushels	7	8	0
II-A	Irrigated	Alfalfa	3	33	3.8 tons	[2] 5	34	[2] 5
		Grain sorghum	1	11	23.5 cwt	0	22	0
		Cotton	4	45	1.11 bales	44	20	0
		Wheat	1	11	30.0 bushels	36	16	0
	Dryland	Alfalfa	3	30	1.3 tons			
		Alfalfa seed			1.4 cwt.[3]	[2] 5	7	[2] 5
		Grain sorghum	1	10	12.5 cwt	0	0	0
		Cotton	4	40	0.37 bales	6	3	0
		Wheat	2	20	14.0 bushels	5	4	0
II-B	Irrigated	Alfalfa	3	33	3.8 tons	[2] 5	35	0
		Grain sorghum	1	11	25.5 cwt	0	20	0
		Cotton	4	45	1.18 bales	46	24	0
		Wheat	1	11	33.0 bushels	39	18	0
	Dryland	Alfalfa	3	33	1.2 tons			
		Alfalfa seed			1.3 cwt.[3]	[2] 5	3	0
		Cotton	3	34	0.35 bales	3	3	0
		Wheat	3	33	14.0 bushels	5	3	0

[1] In many instances, the fertilizer requirement is not the same as the nutrients removed, as an allowance is made for fertilizer to be applied to one crop in sufficient quantity to carry over to the next. As explained in the text, annual rates of application might differ from the above.
[2] This is starter fertilizer, and the quantity shown is the application for the first year.
[3] Yield of alfalfa seed is on an annual basis, but the seed crop is taken at an average of 1 in 2 years.

and average annual fertilizer requirements for intermediate conditions are shown (table 43). Under actual farm conditions, small annual requirements for fertilizer would be combined into less frequent applications. This procedure is followed in budgeting.

Fertilizer requirements shown are estimated on the basis of the nutrients removed by crops and the need of replacement. For cotton, these estimates closely approximate the actual amounts of N and P_2O_5 used on the W. C. Austin Project by farmers who are obtaining comparable yields. (See table 15.)

It is doubtful whether the potentialities can be maintained under irrigation on part of the class II–B soils with the rotation shown in table 43. These soils have characteristics which under irrigation lead to deterioration of soil structure, to accumulation of salt, to poor drainage, and so on. A rotation that includes a high percentage of fibrous-rooted crops, such as grass, would tend to maintain these soils in tillable condition suitable for irrigation for a longer period.

Budget Standards

TABLE 44.—*Seeding rates and costs of seed for specified crops, W. C. Austin Project*

Crop	Seed per acre [1]		Price per unit		Notes
	Irrigated	Dryland	1953 [2]	Projected [3]	
	Pounds	*Pounds*	*Dollars*	*Dollars*	
Wheat	60	40	0.04	0.04	
Oats	48	32	.05	.05	
Cotton	20	16	.10	.10	Fuzzy seed (includes 25 percent reseeded).
Potatoes	1,200		.05	.04	Certified seed.
Grain sorghum	7	6	.08	.08	
Alfalfa	15	12	.35	.41	
Blue panic	2		1.50	1.50	
Pasture mixture:					
Bromegrass	5		.35	.31	
Orchardgrass	5		.35	.30	
Kentucky 31 fescue	3		.27	.27	
Ryegrass, perennial	3		.19	.17	
Madrid sweetclover	2		.30	.30	
Sudangrass	30	20	.12	.10	Drilled rate.
Sweetclover	9	9	.10	.10	Seeded with oats.
Vetch, hairy [4]	15			.15	Drilled.
Rye	45			.04	

[1] Seeding rate when sown alone. If sown as a nurse crop, the quantity of seed should be reduced from 30 to 50 percent.

[2] Compiled from various sources.

[3] Adjusted to "215" index.

[4] For overseeding with blue panic.

TABLE 45.—*Projected prices, Oklahoma, with comparisons*
[At "215" price level]

Commodity [1]	U. S. prices			Oklahoma prices		
	1949	1952	Projected	1949	1952	Projected
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Wheat.....bushel..	1.88	2.12	1.50	1.87	2.13	1.47
Oats.....do..	.66	.84	.70	.72	.92	.76
Corn.....do..	1.24	1.64	1.30	1.16	1.79	1.26
Sorghums, grain.....cwt..	2.02	2.71	1.90	1.96	2.67	1.90
All hay, baled.....ton..	21.20	24.60	18.00	16.00	32.50	15.30
Alfalfa hay, baled.....do..	.....	.....	.....	.....	37.71	17.75
Alfalfa seed.....cwt..	.....	.....	.....	.....	30.50	30.00
Cotton.....pound..	.29	.37	.22	.28	.34	.21
Cottonseed.....ton..	43.40	66.80	62.00	42.40	70.50	64.60
Potatoes.....bushel..	1.27	2.36	1.00	1.60	2.95	1.18
Sweetpotatoes.....do..	2.13	3.78	1.55	2.31	4.10	1.84
Cattle, all beef.....cwt..	19.80	24.80	17.25	18.30	22.96	15.70
Veal calves.....cwt..	.....	27.20	18.92	.....	25.99	17.78
Feeder, calves under 500 pounds.....cwt..	.....	.....	.....	.....	.....	17.60
Fat steers, choice, 900–1,000 pounds.....do..	.....	.....	.....	.....	.....	18.25
Cull beef cows, 1,000 pounds and over.....do..	.....	.....	.....	.....	.....	14.00
Sheep.....do..	9.30	10.60	8.60	9.60	9.91	8.20
Lambs.....do..	22.40	24.70	19.00	23.20	24.62	19.10
Hogs.....do..	18.10	18.00	16.25	18.60	18.22	16.30
Chickens.....pound..	.27	.26	.26	.23	.21	.21
Family cow.....each..	.....	.....	.....	.....	.....	125.00
Beef bull.....do..	.....	.....	.....	.....	.....	250.00
Eggs.....dozen..	.45	.42	.38	.40	.36	.33
Wool [2].....pound..	.49	.54	.44	.38	.43	.35
Milk, wholesale.....cwt..	3.95	4.90	3.85	4.13	5.39	3.84
Butterfat (in cream).....pound..	.62	.74	.58	.55	.67	.52
Cottonseed meal [3].....ton..	77.60	109.00	73.50	76.80	118.00	72.50

[1] All prices at local shipping or receiving points except hay, which is farm price.
[2] Oklahoma figure for 1952 is the June price.
[3] Price paid by farmers. Projected figures represent 1949 price, adjusted by the United States index of feed prices.

TABLE 46.—*Farm equipment, estimated prices, depreciation and repairs, W. C. Austin Project*
[At "215" price level]

Machine	Size and type	Cost new	Life	Repairs		Depreciation	
		Dollars	*Years*	*Percent*	*Dollars*	*Percent*	*Dollars*
Plow, moldboard	2–14 inch	179	15	3.0	5.37	6.0	10.74
2-way rollover	16-inch	427	15	4.0	17.08	6.0	25.62
Disk, tandem	8–foot	248	17	2.0	4.96	5.3	13.14
Harrow:							
Spike tooth	3–section	93	20	1.0	.93	4.5	4.60
Spring tooth	3–section	93	17	1.0	.93	5.3	4.60
Tractor, rubber wheels	DBHP [1] 20–22	1,337	10	(2)		9.0	120.33
Tractor, rubber wheels	DBHP 25–26	1,680	10	(3)		9.0	151.20
Tractor, rubber wheels	DBHP 40–43	2,192	10	(4)		9.0	197.28
Rotary hoe	4–section	292	15	2.0	5.84	6.0	17.52
Grain drill	16–foot	431	20	1.0	4.31	4.5	19.40
Grain combine (self-propelled)	15–foot	4,200	10	7.0	294.00	9.0	378.00
Combine (small-seed)	6–foot motor	1,096	10	7.0	76.72	9.0	98.64
Cotton planter	2–row	208	15	2.0	4.16	6.0	17.52
Do	4–row	424	15	2.0	8.48	6.0	25.44
Cotton stalk shredder		250	15	1.0	2.50	6.0	15.00
Potato planter	2–row	400	11	2.0	8.00	8.2	32.80
Cultivator, cotton or sorghum	2–row	197	14	2.0	3.94	6.4	12.61
Do	4–row	387	14	2.0	7.74	6.4	24.77
Mower	7–foot	212	12	2.5	5.30	7.5	15.90
Rake, side-delivery	10–foot	256	15	1.5	3.84	6.0	15.36
Potato digger	1–row	300	17	1.5	4.50	5.3	15.90
Do	2–row	400	17	1.5	6.00	5.3	21.20
Pickup hay baler	1–man, wire	2,192	10	7.0	153.44	9.0	197.28
Trailer, cargo	2–wheel, rubber	110	15	4.0	4.40	6.0	6.60
Do	4–wheel, rubber	124	15	4.0	4.96	6.0	7.44
Sprayer	9–row	164	15	2.0	3.28	6.0	9.84
Leveler, land	30–foot	639	15	1.5	9.58	6.0	38.34

TABLE 46.—*Farm equipment, estimated prices, depreciation and repairs, W. C. Austin Project—Cont.*

[At "215" price level]

Depreciation	Repairs	Cost new	Life	Repairs		Depreciation	
		Dollars	*Years*	*Percent*	*Dollars*	*Percent*	*Dollars*
Ditcher	6-foot	110	15	1.5	1.65	6.0	6.60
Do	Homemade	45	10	2.0	.90	10.0	4.50
Float, land	do	50	10	2.0	1.00	10.0	5.00
Chiseling equipment	9-shank, with blade	84	15	1.5	1.26	6.0	5.04
Siphon tubes, irrigation		1.5	10			10.0	.15
Tarpaulins, irrigation		8	5			20.0	1.60
Manure spreader		274	15	1.0	2.74	6.0	16.44
Auto	Secondhand	[5] 438	7	[6]		11.8	51.68
Pickup	do	800	6	[7]		15.0	120.00

[1] Drawbar horsepower.
[2] Cost of gas, oil, and repairs estimated at \$0.33 per hour.
[3] Cost of gas, oil, and repairs estimated at \$0.45 per hour.
[4] Cost of gas, oil, and repairs, estimated at \$0.51 per hour.
[5] Assumed to be purchased when 3 years old for \$1,200 (60 percent of cost new).
[6] Cost of gas, oil, repairs, license, and insurance estimated at \$0.04 a mile; 3,000 miles of farm driving (half of total).
[7] Operating costs (see footnote 6, above) estimated at \$0.05 a mile.

TABLE 47.—*Rates for equipment rental for contract and custom work, and for hired labor— W. C. Austin Project*

[Reported 1952, and projected ("215" level) prices]

Item	1952 rate		"215" rate	
	Equipment rental	Custom or contract	Equipment rental	Custom or contract
Small grain:	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Combining, less than 40 acres ... acre		4.00		4.00
Combining, 40 acres or up ... do		3.00		3.00
Hauling, to elevator ... cwt		.10		.10
Alfalfa:				
Baling hay ... ton		5.50		4.00
Combining seed ... acre		6.00		5.00
Cleaning seed ... cwt		2.00		1.50
Cotton:				
Hand snapping and hauling ... cwt. of lint		9.00		6.50
Ginning and bagging ... cwt. of lint		3.90		2.80
bale		19.50		14.00
Spraying or dusting [1] ... acre		2.65		2.00
Potatoes:				
Cutting seed ... cwt		.50		.35
Picking ... cwt				
Swamping ... cwt		.25		.20
Hauling ... cwt				
Sacks, field use ... cwt				
Sorting ... cwt				
Washing ... cwt		.70		
Sacking ... cwt				
Selling ... cwt				
Spraying [1] ... acre		4.00		3.00
Digging, two-row ... do	5.00		3.60	
Planting, two-row ... do	3.00		2.15	
Grain sorghums:				
Combining ... do		5.00		4.00
Applying anhydrous ammonia ... do		1.00		.75
Hired labor:				
By the day ... hour		.75		.60
By the month ... month		125.00		100.00

[1] Includes average cost of materials and airplane charge of $0.50 per acre.

TABLE 48.—*Miscellaneous expense items*

[Projected at "215" index]

Item	Cost per unit
Electricity used any one month:	*Dollars*
1st 40 kwh ... kilowatt-hour	0.0750
2d 40 kwh ... do	.0500
Next 20 kwh ... do	.0250
Next 300 kwh ... do	.0120
All over 400 kwh ... do	.0175
Real and personal property taxes ... $1.00 inventory value	.0075
Insurance on farm buildings ... $1,000 inventory value	5.0000
Telephone (farm share) [1] ... month	2.0000
Baling wire ... ton of hay	.5000
Irrigation water, O and M ... acre	3.5000
Irrigation construction ... do	1.5000

[1] One-half of total.

TABLE 49.—*Land values and development costs per irrigable acre, used in budgets, W. C. Austin Project* [1]

Soil area	Irrigated land reflecting present capitalization (1953)		Dry cropland		Dry pasture		Development costs			
							Already done (to May 1953) [2]		Additional needed to complete development [3]	
	1953 values	Adjusted to "215" index	1953 values	Adjusted to "215" index	1953 values	Adjusted to "215" index	Land	Structures	Land	Structures
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
I	258	186	122	88	38	27	11	5	39	5
II-A	231	166	102	73	38	27	11	5	53	5
II-B	233	168	111	80	43	31	11	5	34	5
Project average (weighted)	241	174	113	81	40	29	11	5	40	5

[1] Average 1946–50 Oklahoma land values appear to be consistent with the projected "215" price index. Therefore reported 1953 prices were adjusted to the 1946–50 average. Development costs were adjusted to a "215" index by use of United States index of prices paid for building and fencing.

[2] Project average used for each area, as area differences reported were not significant.

[3] Estimated by Soil Conservation Service technicians.

TABLE 50.—*Repair and depreciation rates on buildings and other improvements, W. C. Austin Project* [1]

Item	Cash repair	Rate of depreciation
	Percent	*Percent*
Barn and other farm buildings	1	4.0
Fences	8	(2)
Domestic water system	1	2.5
Irrigation structures	1	4.0

[1] As percentage of new cost.
[2] Repair charge is adequate to maintain fence.

TABLE 51.—*Index numbers of prices paid for selected items in 1952 and at projected "215" index*

[1910–14 = 100 except for land]

Item	1952	Projected "215" index	Percentage which "215" index is of 1952 prices
Farm machinery, United States	308	225	73
Buildings and fencing materials, United States	348	250	72
Fertilizer, United States	156	130	83
Wages, United States	503	360	72
Farmland, Oklahoma [1]	282	203	72

[1] 1935–39 = 100, projected land value is equal to 1946–50 average.

TABLE 52.—*Labor requirements per acre of crops using 2-row equipment, W. C. Austin Project* [1]

Crops	Irrigated				Dry land			
	Sandy soils		Heavy soils		Sandy soils		Heavy soils	
	Man	Tractor	Man	Tractor	Man	Tractor	Man	Tractor
	Hours	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*	*Hours*
Wheat [2]	3.8	2.6	3.8	2.6	2.3	2.3	2.3	2.3
Oats	4.5	3.0	4.5	3.0				
Sorghum, grain [2]	7.7	4.6	6.1	4.2	3.4	3.4	3.1	3.1
Alfalfa hay [3]	10.4	4.9	7.5	4.2	3.6	3.6	3.3	3.3
Alfalfa hay and seed [4]	9.4	3.9	6.6	3.3	2.6	2.6	2.4	2.4
Sudangrass, pasture	5.3	3.1	4.7	2.9	2.9	2.9	2.8	2.8
Cotton [2] [5]	13.2	4.2	11.5	4.4	9.2	4.0	9.5	4.3
Potatoes			10.4	5.2				

[1] Adapted from unpublished material prepared by W. F. Hughes, Production Practices for Irrigation-Crops on the High Plains; and from (*4*).
[2] Preharvest.
[3] Includes allowance for establishment of stand, preharvest operations, mowing and raking—4 cuttings if irrigated, 3 cuttings if dry.
[4] One seed crop plus 3 cuttings if irrigated, 2 cuttings if dry. Does not include time for combining seed.
[5] For snapping and hauling cotton, add 10.4 man-hours per cwt. of lint and 0.4 tractor hour.

TABLE 53.—*Cotton: Number of hoeings, and man-hours required per hoeing, on farms surveyed, 1952*

Land-class area [1]	Average number of hoeings	Man-hours per hoeing per acre	Total man-hours hoeing per acre
	Number	*Number*	*Number*
I	2.1	2.7	5.6
II–A	1.6	2.7	4.3
II–B	1.7	3.1	5.3
Average for all areas [2]	1.8	2.9	5.2

[1] For a description of areas, see page 9.
[2] Weighted.

TABLE 54.—*Farmers reporting specified months in which cotton was planted and irrigated, survey farms, W. C. Austin Project, 1952*

Date performed	Farmers reporting—		
	Planting	Preirrigation	Irrigation after planting
	Number	*Number*	*Number*
Before February		[3] 1	
February		1	
March		5	
April	[1] 13	12	
May	[2] 33	1	1
June			26
July			38
August			31
September			1

[1] All in last half of month.
[2] All in first half of month.
[3] November.

TABLE 55.—*Specified numbers of irrigations on selected crops, reported by farmers, survey farms, W. C. Austin Project, 1952*

Crop	Total number of farmers reporting	Average number of irrigations	Farmers reporting— No irrigation	1 irrigation	2 irrigations	3 irrigations	4 irrigations	5 irrigations	6 irrigations	7 irrigations	8 irrigations
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Cotton	66	3.2	1	1	15	26	17	4	2	0	0
Alfalfa hay	34	3.4	3	3	3	10	7	3	3	1	1
Grain sorghum	15	2.0	3	2	4	4	2	0	0	0	0
Wheat	14	.4	16	1	1	1	0	0	0	0	0
Sudan	14	3.1	2	0	6	2	1	0	1	1	1
Pasture	11	3.4	2	0	3	1	1	2	1	0	1
Oats	8	.8	5	1	1	1	0	0	0	0	0
Sorghum forage	8	2.9	1	2	0	3	1	0	0	0	1
Soybeans	5	3.6	0	0	1	1	2	1	0	0	0
Castorbeans	3	4.3	0	0	1	0	1	0	0	1	0
Sweetclover	2	1.5	1	0	0	1	0	0	0	0	0
Potatoes	1	5.0	0	0	0	0	0	1	0	0	0

TABLE 56.—*Average size of farm, acres irrigable and dryland, land use and major crops, by tenure, land-class area I, W. C. Austin Project, 1950* [1]

Tenure and land group	Acres per farm	Land use, as percentage of total acreage			Major crops, as percentage of cropland			
		Crops	Pasture	Other	Wheat	Cotton	Grain sorghum	Alfalfa
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Owner-operators:								
Irrigable	121	97	1	2	20	40	13	13
Dryland	196	64	31	5	32	15	12	9
All land	317	76	20	4	26	28	12	11
Part owners:								
Irrigable	94	97	0	3	3	46	21	17
Dryland	163	84	9	7	22	19	21	16
All land	257	89	6	5	15	29	21	16
Tenants:								
Irrigable	94	97	0	3	3	37	27	15
Dryland	84	74	18	8	33	16	31	14
All land	178	87	8	5	16	28	22	15
All farms:								
Irrigable	106	97	0	3	12	40	20	14
Dryland	146	70	24	6	30	16	20	12
All land	252	81	14	4	20	28	17	13

[1] Compiled from Production and Marketing Administration data for Jackson and Greer Counties, Okla.

TABLE 57.—*Average size of farm, acres irrigable and dryland, land use, and major crops by tenure, land-class area II-A, W. C. Austin Project, 1950* [1]

Tenure and land group	Acres per farm	Land use, as percentage of total acreage			Major crops, as percentage of cropland			
		Crops	Pasture	Other	Wheat	Cotton	Grain sorghum	Alfalfa
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Owner-operators:								
Irrigable	91	98	0	2	34	26	20	10
Dryland	131	70	24	6	13	14	22	11
All land	222	82	14	4	23	20	21	10
Part owners:								
Irrigable	153	99	0	1	13	48	8	14
Dryland	244	84	10	6	33	13	12	10
All land	397	90	6	4	24	28	10	12
Tenants:								
Irrigable	101	98	0	2	12	45	21	11
Dryland	101	85	6	9	37	8	30	7
All land	202	92	3	5	23	28	25	9
All farms:								
Irrigable	107	98	0	2	19	40	17	11
Dryland	138	80	13	7	27	12	21	9
All land	245	87	8	5	24	25	19	10

[1] Compiled from Production and Marketing Administration data for Jackson and Greer Counties, Okla.

TABLE 58.—*Average size of farm, acres irrigable and dryland, land use, and major crops by tenure, soil area II-B, W. C. Austin Project, 1950* [1]

Tenure and land group	Acres per farm	Land use [2]			Major crops [3]			
		Crops	Pasture	Other	Wheat	Cotton	Grain sorghum	Alfalfa
	Number	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Owner-operators:								
Irrigable	146	98	0	2	35	18	27	6
Dryland	123	77	16	7	60	2	11	7
All land	269	89	7	4	45	12	20	6
Part owners:								
Irrigable	236	98	0	2	35	20	27	2
Dryland	456	64	28	8	46	8	11	6
All land	692	76	18	6	41	14	18	4
Tenants:								
Irrigable	123	98	0	2	24	22	34	6
Dryland	129	84	10	6	41	12	16	10
All land	252	91	5	4	33	17	26	8
All farms:								
Irrigable	158	98	0	2	32	20	29	4
Dryland	202	72	21	7	48	8	13	7
All land	360	83	12	5	40	14	21	6

[1] Compiled from Production and Marketing Administration data for Jackson and Greer Counties, Okla.
[2] Percentage of total acreage in farm.
[3] Percentage of cropland.

TABLE 59.—*Ownership of special equipment for irrigation farming on tenant-operated farms, W. C. Austin Project, 1953*

Item of equipment	Owned by—			
	Landlord		Tenant	
	Farms reporting	Average value	Farms reporting	Average value
	Number	*Dollars*	*Number*	*Dollars*
Two-way plow	0	0	3	300
Land leveler	0	0	0	0
Float	1	500	3	233
Ditcher	2	103	4	156
Siphon tubes	2	223	14	204
Tarps	1	36	12	55
Weed burner	1	22	0	0
Bordering machine	0	0	2	110
Farms reporting special irrigation equipment and average value per farm reporting	4	303	18	331

TABLE 60.—*Farmstead water systems, W. C. Austin Project, 1953* [1]

Land-class area [2]	Farms reporting	Farms with wells	Average depth of well	Farms with pressure water systems [3]
	Number	*Number*	*Feet*	*Number*
I	27	21	31	14
II-A	16	12	33	5
II-B	26	13	28	16
Total or average	69	46	31	35

[1] Some farms in the survey had no farmstead water systems. Some farms without wells used cisterns or hauled domestic water from a neighbor's well.
[2] For description of areas, see page 9.
[3] Some pressure systems were used with cisterns.

TABLE 61.—*Change in size of operating units, sample farms, W. C. Austin Project, from first year of receiving irrigation water to 1952*

Land area and 1952 size group (irrigable acres)	Farms in group	Farmers reporting increases in—			Farmers reporting decreases in—			Average total acreage per farm	
		Irrigable acres	Non-irrigable acres	Net size [1]	Irrigable acres	Non-irrigable acres	Net size	First year of irrigation	1952
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Acres*	*Acres*
Land area I:									
20–59	9	0	2	1	3	0	2	173	173
60–99	9	0	0	0	1	1	1	198	187
100–179	8	2	1	2	0	0	0	164	182
180–379	1	1	0	1	0	0	0	142	342
All sizes	27	3	3	4	4	1	3	177	187
Land area II–A:									
60–99	8	2	2	2	1	2	1	151	141
100–179	7	0	3	2	3	0	0	216	234
180–379	1	0	0	0	0	0	0	206	206
All sizes	16	2	5	4	4	2	1	183	186
Land area II–B:									
60–99	8	1	0	1	0	0	0	184	177
100–179	8	0	2	1	2	1	2	249	236
180–379	10	6	4	7	0	1	0	266	349
All sizes	26	7	6	9	2	2	2	236	261
All areas, total or weighted average	69	12	14	17	10	5	6	201	215

[1] Calculated on basis of 1 irrigable acre = 3 nonirrigable acres, the approximate ratio of present values.

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